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COMPUTERWORLD

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In Depth
Debugging as a science/**35**

Mainframes and superminis
Part One of CW's annual Hardware Roundup/**23**

AI product deluge hits DP market

Mainstream vendor releases on eve of major conference seen hastening corporate acceptance of AI technology

Will 'big boys' hurt pioneers?

By John Gallant
CW Staff

Recent artificial intelligence product unveilings by IBM, Digital Equipment Corp. and Control Data Corp. indicate that AI is growing out of its infancy. The spate of announcements may have been prompted by the International Joint Conference on Artificial Intelligence, being held in Los Angeles this week, where a number of AI-related products are expected to be introduced and demonstrated.

The availability of AI tools from mainstream manufacturers, analysts said last week, will make it easier for DP managers to begin experimenting with the emerging AI technologies. On the other hand, they lamented the fact that the entrance of what one of them called "the big boys" into the AI market could also spell trouble for the firms that first broke ground in the field.

"In one sense, you can say that IBM and DEC have legitimized AI by offering products," said Howard Dicken, publisher of "AI Trends," a newsletter put out by DM Data, Inc., a Scottsdale, Ariz.-consulting firm. "DP managers now have an easier path to follow in experimenting with AI."

Karl Wiig, director of Cambridge, Mass.-based Arthur D. Little, Inc.'s Artificial Intelligence Program, agreed. Wiig said companies will be more willing to explore potential AI applications that use existing hardware, software and personnel.

"We think more firms will begin to ex-

See **AI** page 5

> *'IBM and DEC have legitimized AI by offering products. DP managers now have an easier path to follow in experimenting in AI.'*
>
> — **Howard Dicken**
> **"AI Trends"**

DEC: workstation CDC: AI languages

Artificial intelligence products unveiled this month by Control Data Corp. and Digital Equipment Corp. further highlight a market segment gathering momentum.

DEC's AI Vaxstation was built around the Microvax II and comes bundled with VAX Lisp, DEC's implementation of the Common Lisp language standard. The firm also announced agreements with third-party vendors to provide high-level AI tools to complement DEC's base-level language offerings (see story page 4).

CDC offered users of its Cyber 180 mainframes two high-level AI programming languages as well as an expert system development environment, which takes advantage of the 180's large virtual and real memory capacities. The company also announced a package of programming tools for its NOS/VE operating system (see story page 5).

IBM unwraps expert tools

By John Gallant
CW Staff

WHITE PLAINS, N.Y. — IBM has brought the worlds of artificial intelligence and mainstream DP more closely into line with the introduction of an expert system development tool and a Prolog language environment for its VM operating system. IBM unveiled the products earlier this month but did not distribute the information to users until last week.

IBM's Expert System Environment/VM and its VM Programming in Logic, slated for September availability, were both designed to aid users in building expert systems and other AI programs — which can draw information from existing IBM systems — in an IBM mainframe environment.

The tools facilitate research and development without requiring specialized AI hardware, IBM said. The debuts were met with praise from AI analysts and researchers, many of whom nevertheless criticized IBM for its wait-and-see approach to providing commercial AI tools for its users (see story far left).

IBM's low-key announcement came amid a flurry of recent AI-related activity that saw additional product unveilings from Digital Equipment Corp. and Control Data Corp.

According to an IBM spokeswoman, VM Programming in Logic is IBM's implementation of Prolog — one of two symbolic manipulation languages, Lisp being the

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NEWSPAPER

TOP OF THE NEWS

The beating goes on. Recent actions by some minicomputer vendors and rumblings from AT&T indicate the computer industry has yet to scrape bottom. **Page 2.**

■

A computer modeling program is the focus of a debate about what caused a delay in residents being notified of a toxic gas leak in West Virginia. **Page 6.**

■

Business overhead. Graphics users polled at Computer Graphics '85 East say they prefer using overhead transparencies to slides in presentations. **Page 10.**

■

After she was arrested, strip searched and jailed, based on inadequate information fed into an FBI computer, a New Jersey woman is suing for damages. **Page 12.**

Go ahead, make my DEC: Olsen speaks

By Clinton Wilder
CW Staff

The overstuffed armchair in the corner of the corporate interview lounge is wasted on Ken Olsen. The 59-year-old founder and president of the world's second largest computer company is usually on the chair's edge, stridently defending Digital Equipment Corp.'s microcomputer strategy or attempting to quash the latest rumors of a marriage between DEC and AT&T. When someone is as supremely confident of the future success of his company as Olsen is and wants the world to know it, it is not easy to relax.

In an interview with *Computerworld* last week that touched on many topics, Olsen disclosed that he has set a date when he will relinquish the DEC helm, but he would not divulge the details. "Without a date, one never leaves," Olsen said, adding only that the date is still not imminent. When it does arrive, he predicted, DEC will have sailed through a minicomputer industry shakeout to strengthen further its position as the leading vendor of mid-range computer systems.

"Right now or very soon, we might be able to make all the minicomputers the world needs," Olsen said. "There is not room for many manufacturers in that market. That means there are going to be exciting changes in this world of ours. There will be some things that we want nothing to do with because they're too easy for others. But there are some things that take size and technology to

See **OLSEN** page 8

Mini firms eyeing more cuts

By Peter Bartolik
CW Staff

Actions by several minicomputer systems vendors last week demonstrated that the widespread sales slump has yet to run its course.

AT&T Information Systems responded to a printed report of impending layoffs by telling employees that it is considering cost-cutting measures. Motorola/Four Phase Systems, Inc. announced a consolidation and reorganization. Meanwhile, Harris Corp. reported a loss in its semiconductor operations and reduced profits in its information systems businesses, with no likelihood of any improvement by the end of the year.

Additionally, Westford, Mass.-based Massachusetts Computer Co. (Masscomp) said it has cut salaries by 6% to 12% and instituted other measures to lower expenses "during the current period of unfavorable business conditions." Masscomp manufactures 32-bit systems.

AT&T Information Systems declined to respond to a *Wall Street Journal* report that a large round of layoffs is imminent, but the top executive of the AT&T division informed employees that some cost-cutting measures are likely.

A company official told *Computerworld* that Robert E. Allen, chairman and chief executive officer of the group, reassured several hundred employees that they would be the first to hear of any cost-cutting decisions.

Allen's meeting was Wednesday morning, the same day as the *Journal* report, but had been scheduled previously. The executive reportedly told employees that the group has had successes in its markets but that the company must now make those successes pay off "on the bottom line."

The group is attempting to cut costs and is currently trying to determine how, in what way and when to do so, Allen said.

At Motorola/Four Phase, a minicomputer and microcomputer systems manufacturer, there has been a restructing into two separate business units, according to Dan Halloran, Motorola/Four Phase's vice-president of human and physical resources. The company's minicomputer business unit will remain based in Cupertino, Calif., where the company is headquartered. The microcomputer business unit, which manufactures systems that use AT&T's Unix operating system, will be relocated to existing facilities in Tempe, Ariz.

Approximately 500 employees will be affected throughout the company, but all affected employees of the micro business unit will be invited to relocate to the Tempe facility, Halloran said. In a prepared statement, the company said the reorganization was initiated "to increase emphasis on our product lines and to position ourselves [better] to come out of the current industry slump." Halloran said that efforts will be made to relocate employees within the company and that others will be offered services for outplacement. He declined to reveal total employment figures.

> ”
>
> *Masscomp said it has cut salaries by 6% to 12% to lower expenses 'during the current period of unfavorable business conditions.'*

Melbourne, Fla.-based Harris reported last Tuesday that revenue for the fiscal year ended June 30 was up 14% from the previous year to $2.3 billion but that profits declined to $80.3 million, or $2 per share, from year-earlier profits of $80.4 million, or $2.02 per share.

In the fourth quarter, however, profits were $16.1 million, or 40 cents per share, down 33% from the year-earlier level of $23.9 million, or 60 cents per share. Revenue increased 4% to $610.4 million.

Harris reported that semiconductor sales were up for the year, but profits were down because of reduced demand and lower prices. The company also reported that operations from that sector posted a loss in the fourth quarter. Information systems products had a marginal increase in sales for the year, but profits were down substantially because of price competition and the strength of the dollar in overseas markets, the company said.

Joseph A. Boyd, chairman of the company, said in a prepared statement that there are no signs of an upturn in the DP and chip markets during the remainder of the calendar year and that profits for that period are expected to be significantly lower than the comparable period last year.

Random access

Facing the threat of a libel suit, the Computer and Business Equipment Manufacturers Associ ation (Cbema) has withdrawn its harshest criticism of Sentinel Bio-Tech Products of Hyannis, Mass., which is marketing a VDT radiation shield [CW, March 11]. Cbema's statement — the result of an out-of-court agreement — said the trade association retains its view that there are no harmful emissions from VDTs "but withdraws its March 6 statements to the effect that Sentinel was acting in an unethical manner in announcing its marketing efforts."

■

Encore Computer Corp., the start-up founded by former Prime President Ken Fisher, revealed last week that the option for Sperry to acquire up to 80% of Encore's 32-bit Multimax systems and related products has been terminated. Encore said Sperry has not tested the expandable system, which is now scheduled to be formally announced in early September and to be available for delivery later in the year. However, the Wellesley Hills, Mass.-based Encore said Sperry remains a significant investor in the company and will continue to evaluate Encore products.

■

Intellicorp of Menlo Park, Calif., a leading artificial intelligence software firm, plans to make three product announcements this week at the International Joint Conference on Artificial Intelligence in Los Angeles. These will include the third major release of the company's Knowledge Engineering Environment (KEE) system; Simkit, which will be used with KEE to create knowledge-based simulation software and PC-Host, which Intellicorp described only as "an implementation of the KEE system on conventional architecture computers."

■

Computer Management Dynamics of Nashua, N.H., will announce a DEC VAX version of its Command report generating software in September. The package will reportedly run on all VAX systems including Microvax I and II.

NEWS SUMMARY

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CORRECTIONS

The quarterly financial results reported for Tektronix, Inc. last week were incorrect [CW, Aug. 12]. For the fourth quarter ended May 25, the Beaverton, Ore., company posted profits of $29.9 million, or $1.45 per share, down from $31.2 million, or $1.60 per share, in the year-earlier quarter. This figure excludes a one-time extraordinary gain. Revenue was $373.7 million, down from $378.9 million in the 1984 fourth quarter.

Tektronix earned $90.2 million, or $4.41 per share, in the fiscal year ended May 25, up from $79.3 million, or $4.06 per share, in fiscal 1984, minus the one-time gain, Tektronix's sales for the year were $1.43 billion, up from $1.33 billion in fiscal 1984.

An article on Digital Equipment Corp.'s fourth-quarter financial results incorrectly referred to a first-ever fourth-quarter-to-first-quarter revenue dip [CW, Aug 12]. The company traditionally experiences a first-quarter decline in revenue from the proceeding quarter.

The Update section on printers contained a cost-justification chart on page Update/17 in which several of the recommended calculations were incorrectly stated [CW, Aug. 5]. A correct version of the chart can be obtained from its creator, C. A. Pesko Associates, Inc., which is located at 1 Snow Road, Marshfield, Mass. 02050.

The number of printers predicted to be shipped will grow from 6.4 million units this year to 15 million printers in four years, unlike previously reported in the Update section on printers [CW, Aug. 5].

WHODUNIT

Sortland Yard warns against "Raffles-type sort programs."

Call (201) 568-9700.

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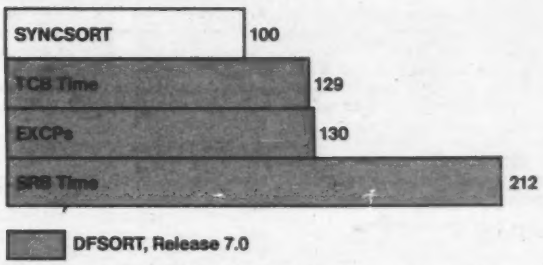
In an extraordinary move, Sortland Yard today warned data processors throughout the world to be on guard against what it termed "gentleman-bandit sort programs."

The warning was issued by one of the Yard's best known figures, Inspector SyncSort, who has sometimes been called "a legend in his own CPU time."

The inspector said, "One of the difficulties in apprehending these chaps is that they look so eminently respectable. They're members of a fine old hardware family. They've been to the right schools. And they invariably carry out their burglaries while wearing a dinner jacket from Saville Row."

EXPERT COMPUTER CRACKERS. "But once the party is underway," the inspector said, "these chaps head straight for the place where the family jewels are kept. They can crack open a computer and make off with a king's ransom in computer resources before you can say 'Hound of the Baskervilles.'"

To indicate "the true cost of this sort of misbehavior," the inspector released the following crime statistics:



SOMETIMES TAKE HOSTAGES. The inspector noted that these black-sheep programs often "take a dreadful toll" of programmers. "They are often tied up for days on end and forced to perform unnecessary coding, compiling and debugging. And they are heartlessly deprived of the labor-saving features that are taken for granted in most parts of the civilized sorting world."

Among these the inspector listed:

- **SORTWRITER**
- **MULTIPLE OUTPUT**
- **RECORD EDITING**
- **FAST FILE COPY**
- **MAXSORT**

TELEPHONE BEST DEFENSE. The inspector urged data processors to call the Yard immediately if they suspect their center is infested by a Raffles-type sort program. "The number is (201) 568-9700. We'll send over one of our highly trained sort detectives to track the culprit down."

Questioned as to what would be done with sort programs caught burglarizing computer centers, the inspector replied. "They will be given a just and speedy trial. If found guilty, they will immediately be transported to Iran!"

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DEC unwraps AI workstation based on Microvax II

Inks third-party software agreements, upgrades OPS5

By Eric Bender
CW Staff

HUDSON, Mass. — Joining this month's parade of new artificial intelligence products, Digital Equipment Corp. has introduced an integrated AI workstation built around the Microvax II. The AI Vaxstation is a fully integrated system that comes bundled with VAX Lisp, the company's implementation of the Common Lisp language standard, and carries a starting price of $48,690.

DEC also announced an upgraded version of its OPS5 expert system development language; an agreement with Quintus Computer Systems, Inc. to sell the Quintus Prolog language for VAX systems; and plans for Artificial Intelligence Corp. to develop VAX versions of its Intellect natural language information management software.

The third-party software announcements demonstrate DEC's AI software strategy of offering base-level languages and development tools itself while working with other vendors to provide higher level tools, said Art Beane, manager for product management and product marketing in DEC's Artificial Intelligence Technology Group.

Scheduled for December availability, the AI Vaxstation is targeted at aerospace, petrochemical, finance, government and academic/scientific research markets, Beane said.

Fortune 1,000 firms most likely initial buyers

Fortune 1,000 corporations are the most likely initial commercial buyers, because "the technology is a fairly expensive technology to look into, and only the largest companies now have the funds," he said.

The AI Vaxstation offers compatibility with standard VAX software, hardware and communications, including hooks into IBM mainframe environments.

"We're taking a general-purpose computer and allowing it to extend the current computing environment," said Joel Magid, senior product manager in DEC's Artificial Intelligence Technology Group. This approach preserves customer investments and simplifies the task of integrating the new machine into DP/MIS operations, he said.

In academic and research markets, the system is not expected to replace dedicated Lisp machines in AI work that demands very high performance and for which price is not an issue, Beane said.

However, he predicted a larger role for the Vaxstation in general computer science courses, because "you can't afford a $170,000 Lisp machine for every student."

A base configuration includes a Microvax II processor with 5M bytes of internal memory (expandable to 9M bytes), 71M-byte hard disk drive, 95M-byte tape subsystem, Decnet/Ethernet interface, a 19-in. monochrome monitor with 1,024- by 860-pixel resolution, keyboard, mouse, VMS operating system and a version of VAX Lisp that integrates more than 150 graphics functions. Disk storage can be expanded to 213M bytes.

The main difference between the new system and a standard Vaxstation is the absence of a floppy disk drive in the AI Workstation.

Version 2 of the VAX OPS5 software tool, available in October, is now a fully supported member of DEC's family of VMS layered products, the company said. Among enhancements, both compile and runtime performance have been significantly improved. Prices range from $3,000 for the Microvax II to $7,500 for the VAX 8600.

Under DEC's three-year marketing agreement with Quintus Computer Systems, Quintus Prolog is being offered for both VMS and DEC's Ultrix-32 operating systems. Cost is $6,000 for the Microvax II and $17,000 for the VAX-11/730 through VAX 8600.

A five-year agreement with Artificial Intelligence will permit DEC to sell VAX versions of Intellect software that run under VMS and interface to the VAX RDB relational data base software. No prices or scheduling details were released.

DEC is located in Maynard, Mass. 01754.

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other, which are currently the most widely used AI development languages. In general, Lisp has held sway among U.S. AI researchers, while Prolog has won the allegiance of developers abroad, most notably in Japan.

In addition to its usefulness in building expert systems — programs that capture and apply the knowledge and reasoning of a specialist in a given field — IBM's Prolog is geared to the development of AI systems for automated deduction, natural language processing, relational data base management system access, knowledge representation and processing and robotics.

Extensive data base searching

Most AI processing is not based on algorithms, as are the majority of traditional applications, but rather on extensive data base searching. As a result, VM Programming in Logic is said to provide what IBM called a built-in mechanism for "nondeterministic top-down, left-right searching with controlled backtracking."

The product also features debugging facilities and the ability to communicate with IBM's VM/SP, SQL/DS and the Lisp/VM environment. VM Programming in Logic will have a one-time charge of $8,000.

The spokeswoman said the Expert System Environment/VM, implemented in Pascal, consists of two complementary systems for the development and execution of expert systems under VM.

The Expert System Development Environment/VM (ESDE/VM) allows a developer, known as a knowledge engineer, to work with an expert to build a knowledge base made up of facts about a particular subject, definitions and rules describing relationships between objects.

The Expert System Consultation Environment/VM (ESCE/VM) enables a user to consult the system to obtain advice or information. ESCE/VM must be in place to operate ESDE/VM, but once a knowledge base has been developed, it can be copied and used by ESCE/VM without ESDE/VM.

ESDE/VM incorporates what is known as an editor program that lets a knowledge engineer build a knowledge base by inputting English-like rules, parameters and controls. The system also provides utilities for syntax checking and debugging. Manipulation of the knowledge base for the creation, deletion, replacement and retrieval of objects and values takes place in main storage. Although that results in the need for additional virtual storage, IBM said it facilitates more rapid searching.

ESCE/VM sets the expert system's inference engine — the reasoning and dialogue manager — in motion. It boasts two basic inference processing functions known as backward and forward chaining. The process of backward chaining allows a user to start with a goal and search backward to find supporting data. Forward chaining involves working with known data to discover facts or goals.

Reduces required storage space

Expert System Environment/VM allows a designer to break a complex problem into smaller subproblems that can be solved independently. Objects entered into the knowledge base are compiled automatically by the system into a form that reduces the amount of required storage space and improves processing. The system offers on-line Help and allows a user to ask what, why and how to receive more detailed explanations of requests for information and reasoning processes involved.

The tool also allows a knowledge base developer to invoke external procedures or acquire data from external sources such as an IBM CMS file or data base.

IBM identified a wide variety of possible expert system applications that it said could be developed efficiently and rapidly with Expert System Environment/VM. Such applications include insurance underwriting and claims processing, financial planning and investment analysis, medical diagnosis, quality assurance, training, product configuration, network and project management and shop floor scheduling.

Expert System Environment, according to the spokeswoman, requires the use of its VM/CMS, the Graphic Data Display Manager, the Pascal/VS compiler and the DCF. The development portion has a one-time fee of $35,000 or a monthly charge of $1,750; the consultation portion has a one-time fee of $25,000 or a monthly charge of $1,250.

Additional information is available from local IBM sales representatives.

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CDC AI tool offerings capitalize on memory capacities

By John Gallant
CW Staff

MINNEAPOLIS — Contributing to the deluge of artificial intelligence tools unleashed recently by large systems hardware vendors, Control Data Corp. offered users of its Cyber 180 computers two high-level AI programming languages and an expert systems development environment. CDC said the AI tools take advantage of the 180's virtual memory and large real memory capacities.

Lisp/VE, CDC's implementation of the emerging Common Lisp standard embraced by a variety of important industry players, can process massive amounts of both symbolic and numeric data, a spokesman said. Full implementation of the Common Lisp specification will be achieved in two releases of the product.

The initial release described by CDC provides a base of functions for most AI programming applications. A future release is slated to complete the specification and offer a compiler designed to improve the performance of production Lisp code and a debugger to increase productivity.

Lisp/VE features a command that allows users to execute operating system commands from within Lisp. Communications between Lisp/VE and external programs are handled by executing the external programs through the command and transmitting data using Ascii files. The Cyber 180's System Command Language provides for data exchange between Lisp/VE and Fortran files.

A version of C-Prolog, CDC's Prolog/VE is a programming language that uses English-like statements of logical relationships together with rules governing the interaction of the relationships. The product consists of an interpreter and an interactive programming environment with tools for incremental program construction, debugging and program modification. A user can edit programs while still within the Prolog system, the spokesman said.

The Knowledge Engineering System/VE (KES/VE), jointly developed by CDC and Arlington, Va.-based Software Architecture and Engineering, Inc., is a set of tools simplifying the development of expert systems.

KES/VE is said to incorporate a range of inference techniques that allow an expert system built with the product to address problems in the most effective processing fashion. The system features a parser for detection of errors.

In addition to the AI programming tools, CDC also unveiled a package of programming tools for its NOS/VE operating system.

The NOS/VE Programming Environments, which support both Fortran and Cobol, combine compilers, editors, debuggers and reference aids. The tools allow a user to develop, debug and install NOS/VE applications without knowledge of the system's command language.

Lisp/VE is priced from $5,166 to $40,614; Prolog/VE from $4,620 to $36,330; KES/VE from $11,424 to $70,594; and the NOS/VE Programming Environments from $1,848 to $14,832, depending on the host.

More information is available from CDC, Computer Systems, P.O. Box 0, HQW09G, Minneapolis, Minn. 55440.

AI from page 1

periment, and that is desirable," Wiig said. "Organizations will be able to bring this new technology in-house and begin to form opinions about it."

But Wiig and Dicken, along with David Hertz, director of the University of Miami's Intelligent Computer Systems Research Institute, pointed out to smaller firms the danger of the growing role of large vendors.

"Who will this hurt? The small guys," Hertz said. "If the Fortune 500 users start talking to the mainframe manufacturers about AI, then it has indeed become a legitimate field. It is no longer blue sky, so to speak. But the small guys will have to have something very good to stay in the market. The AI people have earned their successes by doing things nobody else wanted to bother with. That will not be quite so easy to do in the future. They will have to find special niches."

According to Dicken, an analogy can be drawn to IBM's introduction of its Personal Computer. "IBM's AI systems announcements will not really affect anybody just yet," Dicken said. "But there are some parallels to the micro industry. IBM seems to be doing the same thing it has done in that area. It waited until the early companies broke ground, and then it came in with its own offerings. Some of the smaller companies are bound to get hurt."

While all of the analysts contacted pointed to next week's IJCAI as an immediate spark for the the flurry of product announcements, they also stressed that user interest in AI technologies is also a major factor.

"Nobody would argue that the vendors aren't trying to sell more hardware or make their boxes more useful," Hertz said. "But [the announcements] are primarily a response to what is happening out in the field. Mainframe customers are asking their vendors, 'What are you doing with AI? What should we be doing?' This is clearly more user driven than vendor driven."



NEWS

Union Carbide modeling program given wrong data

By John Desmond
CW Staff

INSTITUTE, W. Va. — A computer modeling program is the focus of a debate on what caused a delay in notifying neighbors of a West Virginia chemical plant that a toxic gas cloud had been released.

Approximately 135 people were hospitalized after the aldicarb oxime gas cloud from a Union Carbide Corp. plant here passed over a four-town residential area early in the morning of Aug. 11.

The modeling program, a package called Safer System from Safety Emergency Systems, Inc. of Westlake Village, Calif., reportedly predicted the gas cloud would remain stable over the plant. Therefore, Union Carbide officials delayed notifying local authorities about the leak for 20 minutes, and an emergency siren was not sounded until after 36 minutes. The gas cloud, however, moved off site and caused illness.

Union Carbide officials said that the company's Safer System was not programmed to track aldicarb oxime, a pesticide ingredient. Instead, an operator relied on methyl isocyanate (MIC) data to judge the behavior of the cloud, the officials said.

The modeling software, which runs on a 32-bit Wicat Systems, Inc. microcomputer, combines the dispersal rates and properties of specific gases with weather factors such as wind speed and direction. The model then predicts where and how fast a cloud will disperse. The Wicat micro, based on the Motorola, Inc. 68000 microprocessor, needs 1M byte of main memory and runs the company's WMCS operating system.

The president of Safety Emergency Systems, Gary Gelinas, said the use of substitute chemical data would result in an incorrect prediction. "It's the old story — garbage in, garbage out," he said.

Thad Epps, Union Carbide's regional coordinator for public affairs, conceded that the program had no data on aldicarb oxime and the model's prediction was inaccurate. "There was gas in places where the system said it would not be," he said.

A spokesman for a competing modeling software firm agreed that the substitution of data on a different gas than that released may have caused the model to make the wrong prediction. Anish Puri, a lead software engineer with Environmental Research and Technology, Inc. of Concord, Mass., said, "The type of chemical would strongly affect the information from the model. The model gives you as good a result as the input it gets. Evidently, [the Union Carbide operators] didn't ask it the right questions."

Programmed for three chemicals

The Safer System program was programmed with data on three chemicals. Data on seven additional chemicals of the hundreds used in the plant was available but had not been added to the system yet, Gelinas said.

The Safer System was installed at the Institute plant after the Dec. 3 leak of MIC from the Union Carbide plant in Bhopal, India, which killed at least 2,000 people. When asked why aldicarb oxime was not part of the program, Epps responded, "We've got literally hundreds of chemicals here. We must make some sort of judgment."

Richard H. Schulze, president of Dallas-based Trinity Consultants, Inc., specialists in emission dispersion modeling, said the wrong prediction could also have been the result of inadequate weather data. "Their problems may have been with meteorology," Schulze said. "They almost would have been better off without the system. They trusted equipment that gave them erroneous information."

The fact the aldicarbe oxime is located 150 yards away from the MIC at the plant would have created a location error, he said, suggesting that this error would not have caused the model's prediction to be so far off. Gelinas said Union Carbide did have two weather stations on-line to the Wicat.

Schulze questioned the reliance on emission dispersion models based on on-line data such as wind speed. "These programs have been sold to safety people as opposed to engineers, because [the systems] provide good [public relations], are attractive visually and can provide a fairly inexpensive way of dealing with a problem you hope you'll never have," he said. "You're better off planning ahead of time and then implementing an emergency plan when the disaster occurs."

Asked whether Union Carbide would have been better off not using the Safer System without the correct chemical data, Gelinas said, "That's a hard question to answer. If they tried to use it to verify a visual sighting, I would say 'no.' But to use the system set up for warning and evacuation with incorrect data would lend itself to a result that was not appropriate. If you put the wrong information in, you won't get the right information out."

IBM to drop disk supplier

By Edward Warner
CW Staff

CHATSWORTH, Calif. — IBM has decided not to renew its 1985 contract to buy 20M-byte hard disk drives from Computer Memories, Inc. (CMI), located here, for use in its Personal Computer AT. The contract expires Dec. 31.

Sales to IBM had accounted for 67% of CMI's revenue in the fiscal year ended March 31 and for 81% of CMI's revenue for the first quarter of the 1986 fiscal year, CMI said.

The Personal Computer AT, introduced one year ago this month, had been plagued with hard-disk problems, some of which IBM has since attributed to a flaw in a chip on the disk's controller card.

Complaints about the AT's hard disk were strongest in the first months after the product shipped. IBM has said that CMI was its sole supplier of Personal Computer AT hard disk drives until the second quarter of this year. The drives are now being made by other suppliers, including IBM.

In confirming reports of IBM's decision, an IBM spokeswoman denied it had anything to do with the high failure rate of the drives. The decision to drop CMI as a hard-disk supplier was made, she said, because "the demands of the marketplace" had changed. That did not mean, she added, that AT sales were in a slump.

CMI's chairman and Chief Executive Officer Irwin Rubin said CMI was disappointed by the decision, but will continue its product development and marketing efforts.

CMI faces a "difficult marketing task" to recoup the sales that will be lost because of IBM's decision, according to David Moy, a computer storage systems analyst with Morgan Stanley & Co., Inc. in New York. The market for personal computer storage systems, he said, is currently depressed.

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Big Blue's baby turns four

Micro given credit for changing industry

By Edward Warner
CW Staff

President Reagan was celebrating the biggest tax cut in U.S. history, the air traffic controllers were on strike, and Lady Diana and Prince Charles were basking in matrimonial bliss.

It was August 1981, the month in which the IBM Personal Computer was born.

A story in *Computerworld* told of how the machine's debut Aug. 12, 1981, marked a departure from IBM tradition; it was to be sold by retail stores — Sears Roebuck & Co. and Computerland Corp. — and third-party software developers were being encouraged to write programs for it. An air-conditioned room would not be required, the story noted.

One software developer, Dave Tarrant, president of Graphic Communications, Inc., was so intrigued that he phoned IBM for details on the new machine. He received a photocopied sheet of technical specifications.

The technical specifications were far more simple than those for today's Personal Computer. When introduced, the machine offered from 16K to 256K bytes of memory and, among other things, a port for use in storing data on a cassette tape recorder. With a monochrome monitor, two diskette drives and 64K bytes of memory, it cost about $4,000.

Today, a Personal Computer comes standard with two diskette drives and 256K bytes of memory and is priced at $2,295.

In the four years since its debut, the Personal Computer "pretty much changed the whole personal computer industry," according to Egil Juliussen, chairman of the board of Future Computing, Inc., a Dallas-based research firm specializing in personal computer topics. The machine, he said, "was the one thing that got the businesses to go on a buying binge for personal computers."

By the end of this year, approximately 4.4 million Personal Computers will be in use around the world, according to Chris Christiansen, senior analyst with the Boston-based Yankee Group.

The Personal Computer, Christiansen observed, "lessened the domination of the data processing department" over its users.

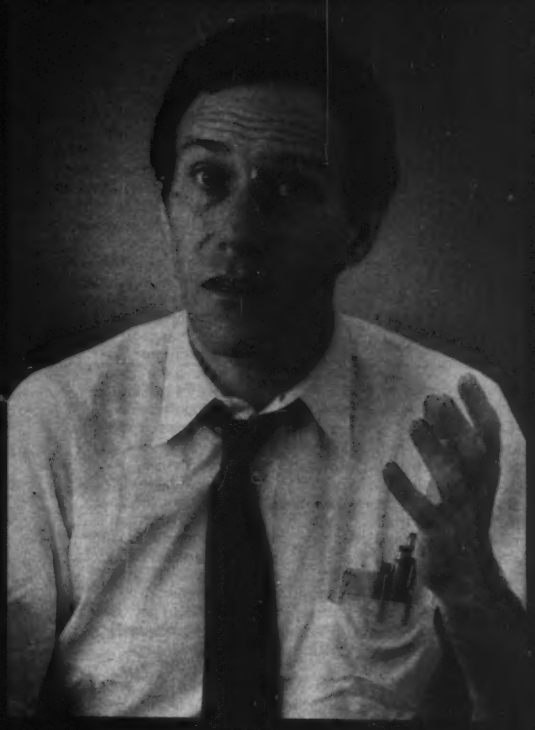
Cigna Corp.'s Bloomfield, Conn., life insurance and investments division was an early user of the Personal Computer and has since installed more than 100 of them.

When Rich Reed, the man who was to become that division's manager of office systems, first saw IBM's future wunderkind, he said he knew its potential exceeded that of any personal computer then in use there, but he had no idea of just how much memory his firm's users would eventually want.

"We thought that 256K [bytes] was a pretty big machine," he recalled. "Something like 320K [bytes] or 512K [bytes] was just enormous."

Sales of the Personal Computer are currently in a slump, and, with four years under its belt, the machine is looking like a mature product, at least in IBM's standard product life cycle. For those reasons, analyst Juliussen predicted the Personal Computer is unlikely to reach age five and will be replaced by its hard disk-equipped big brother, the Personal Computer XT.

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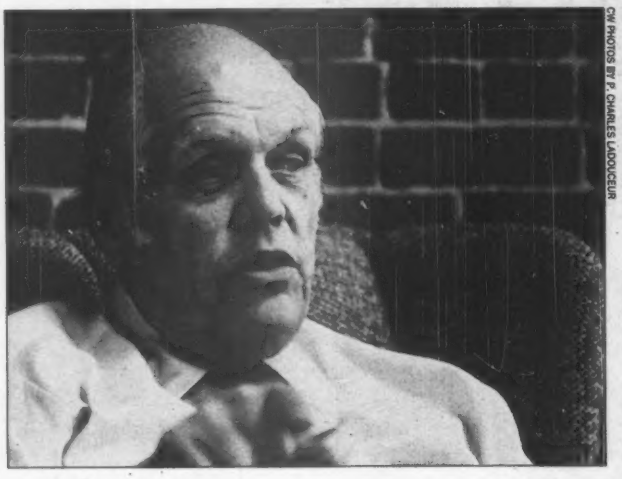
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CW PHOTOS BY P. CHARLES LADOUCEUR

OLSEN from page 1

do, but boy, once we get going with ours . . . That [Microvax II], when we get orders and start pouring those out, we're going to pour them out in huge quantities."

Olsen predicted the minicomputer industry will soon follow the pattern micro vendors experienced, in which those vendors saw their overcrowded ranks thinned drastically largely due to plummeting demand and bloodletting price wars.

"Even if it was 500 [micro vendors] down to 12, that's a major 1,000 change, and it's probably a thousand down to five," he said. "We're going through the same sort of change in many other areas; it's clear the world doesn't want a hundred different general ledger software systems."

One thing the world definitely does want, in Olsen's view, is networking. Corporate users need the means to link micros, minis, mainframes and communications, Olsen said, and the shortage of solutions is partly to blame for buyer hesitation in the current computer industry slump.

"DEC may have helped cause this computer depression," Olsen said, "because I finally convinced people that they need networking and that a bunch of independent computers won't really solve the problem. People, once they get a hint of what networking can do, are afraid to make a move."

DEC's challenge, Olsen said, is to convince users that the minicomputer pioneer can also be the networking solution vendor of the 1980s and beyond. He regales listeners with tales of DEC executives linking VAXs, Decmates, Microvaxs and workstations together over Ethernet but admits the technology will not sell itself. The company's No. 1 priority in 1985 is not to batten down using cost cuts to weather the slump, but to master the hard sell of networking, he said.

"Things people have been looking for, we've got, and no one else will have them for a while," Olsen said. "We've got a message to get across; it just takes time, it takes work. We're not doing too badly, considering the economy. Cutting back is not the challenge. People expect us to cut back, just because everyone else does. With everyone else cutting back, we should go the other way."

DEC is not out rescuing laid-off production line employees from Wang Laboratories, Inc. or Data General Corp., however. Olsen admitted that DEC has scaled back its manufacturing work force, attributing the drop to increasingly automated and streamlined production as well as to the industry slump.

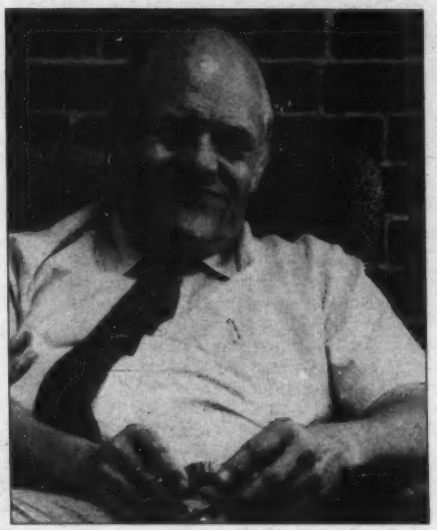
The DEC sales force has grown, but Olsen stressed that all future staffing decisions, including one that would break from the DEC no-layoff tradition, will depend on the business climate.

"The nature of the whole business is [such that] we're always reshuffling things," he said. "Things change, so we have some products we're not making anymore and some we're not selling anymore. We never promised there will be no layoffs, but we see an increasing demand for our products, and the summer's going better than it went last summer. We feel our job is to get that [product] message out, so we're not planning any layoffs."

DEC's next moves on the networking chessboard will probably be on the microcomputer end. "I am not going to announce anything, but we obviously have to have small desktop Microvax workstations, and it's obvious which two we need," Olsen said. "We need one that has got a lot of industry software and one to keep what we have in word processing. . . . The Decmate we have, we still believe, is the best [for] word processing. We've got to integrate that for other things, but we're not quite ready to announce how we'll do that."

Any talk of the future of networking invariably evokes a long shadow emanating from Armonk, N.Y. — and most everyone not wearing blue pinstripes castigates IBM for aiding and abetting the confusion over standards. Olsen, whose suit bears a gray stripe, is obviously among them.

"I don't understand what [IBM is] doing, and I don't think [it has] told anybody completely what [it is] doing," he said. "If you look at what [IBM has] brought out, it's kind of a messy thing, all kinds of wires. I



suspect [IBM is] going to go Ethernet because I don't think there's any other really nice way of doing it. That's my guess, I don't know; I shouldn't even say it publicly.

"When we picked Ethernet, we and a number of others tried to make it industry standard," Olsen continued. "Now, there are two companies [IBM and AT&T] that want to get a monopoly, so they didn't join in. I suspect that IBM will join into that, because I don't think [its] ever going to get [its system] to work. . . . Well, we'll see what happens."

Deflecting recent industry rumors, Olsen stressed that DEC is categorically not interested in reaching out and touching AT&T — in the form of a merger, that is. "We have no interest in the telephone business, and we would be of no value to them if we're not interested," he said. "There have been very few, if any, . . . high-technology unfriendly mergers that have worked out."

Olsen called DEC's recent decision to resume production of the Rainbow micro "absolutely unimportant," and denied any corporate frustration in the world of the IBM Personal Computer standard that DEC belatedly and begrudgingly accepted. "We made our mistakes that we shouldn't have made, but that's not frustrating, that's part of the computer business," he said.

"We'd probably be dead if we were that successful," Olsen added with a grin. "I'd hate to have that much production and have it disappear suddenly, too. We don't do well with too much success. You know, after many years of success, it's awfully hard to cover."

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WEST COAST UPDATE/JEFFRY BEELER

Maintenance programmers have long regarded themselves as members of an unsung, even downtrodden, minority. With the possible exception of operations personnel, no class of information systems professionals ranks lower on the MIS totem pole than the specialists who fix and modify existing software.

Compared with their colleagues who write programs from scratch, maintenance people have traditionally drawn lower salaries and have borne the brunt of departmental budget cuts. Their specialty has also typically been viewed as a mere springboard to applications development rather than as a skilled occupation with its own inherent value. Even the word "maintenance" conjures up images of a blue-collar work force engaged in menial labor, according to Joe Podolsky, Hewlett-Packard Co.'s manager of quality information systems.

For years, maintenance programmers have accepted their lot in life with quiet resignation. But lately, a new assertiveness has begun to emerge among the MIS field's "second-class" citizens. Today, maintenance programmers are demanding the professional respect and recognition they feel they have always deserved but have seldom received.

This mood of rising activism manifested itself at a recent meeting in San Francisco of the Software Maintenance Association (SMA), a new organization that aims to promote the interests of the field and its practitioners. The gathering marked the debut of the nationwide association's Northern California chapter.

During an organizational meeting that lasted roughly two hours, more than 40 attendees discussed a broad range of maintenance-related problems, including their field's widespread disrepute. Virtually no one in the crowd disputed the contention that systems managers and applications developers hold maintenance programmers in low esteem and treat them accordingly.

In the eyes of many of their systems coworkers, maintenance lacks the glamour that is usually associated with applications development, Podolsky said during an interview. Like operations personnel, maintenance programmers daily confront the "real-world messiness" from which their counterparts in development are often insulated.

But Podolsky, who spoke briefly at the SMA meeting, rejected the stereotypical image of maintenance programmers as information systems grunts who necessarily play second fiddle to applications developers. On the contrary, he said, "if I were forced to choose between development people and maintenance people, I think I'd probably choose maintenance people, because in most cases they are the guts of a company."

In its own way, maintenance demands as much technical skill as does development. For one thing, maintenance specialists need to be accomplished detectives merely to pinpoint a software problem in the first place.

Then, they have to be able to "remodel a program in the style of the original architecture so that they are not causing more problems for future programmers," Podolsky said. "That's a challenging task. One of the problems that is almost a legend in software is that once it has been maintained by dozens of people over the years, the code itself becomes virtually unmaintainable."

But technical know-how by itself is insufficient to make a maintenance programmer effective. Maintenance requires at least as much knowledge of business and interpersonal communications as it does of pure programming. "Not only do maintenance people have to fix software itself, but they also have to understand how their organization changes, how software should be adapted and how they should consult their users," Podolsky said.

Because their jobs frequently require them to serve as user advisers, Podolsky prefers to label maintenance programmers as "software support specialist" rather than with their usual job titles.

Podolsky's zeal for maintenance programming apparently typifies the views of many of his peers. "There's certainly more talk these days about software maintenance in a constructive sense than I've seen in the 25 years that I've been in the business," he said.

As evidence of maintenance's growing prestige, Podolsky pointed to recent developments such as the formation of the SMA. The association's mere existence, he said, reflects a growing determination on the part of maintenance programmers to clarify their role for other DP workers, to boost their image and visibility and to improve their own sense of professional self-worth.

A special target of the maintenance field's consciousness-raising efforts is MIS management, which should view the discipline "not as a mechanical process but as the adaptation of a living organism, software, to the real world," Podolsky said.

If a firm's maintenance programmers are discontented, he added, its MIS director will have problems with a group that accounts for half of departmental expenses and that plays a crucial role in determining whether a system succeeds or fails.

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Graphics users prefer transparencies to slides

By Edward Warner
CW Staff

BOSTON — Business graphics users surveyed by *Computerworld* on the floor of the Computer Graphics '85 East conference here last week overwhelmingly preferred to use overhead transparencies rather than slides for business presentations.

Nationwide, the question of whether to use transparencies or slides for business presentations is coming to the fore as computer graphics becomes the dominant means of producing graphs and charts. The cost of slide film recorders is falling, but slides are still limited by technology — they cannot be used in well-lit rooms, for example — and they buck tradition in many firms.

The corporate tradition at Avco Systems Division, a subsidiary of Textron, Inc. in Wilmington, Mass., is to use transparencies, as many as 2,000 a month, according to information center consultant Elizabeth Deware. The company, she said, prefers transparencies for their ease of use and because it has very few slide projectors on site.

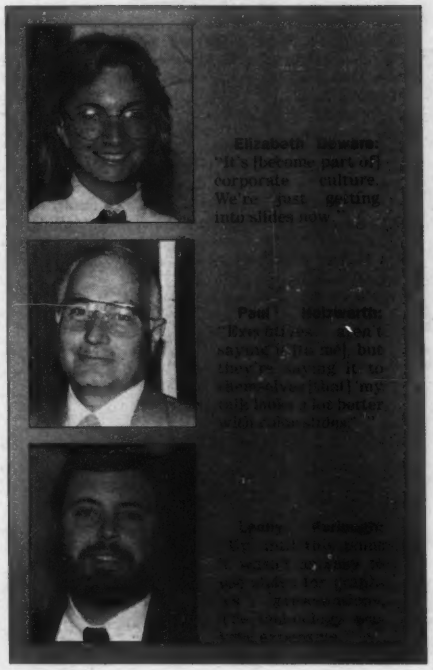
At a General Motors Corp. manufacturing plant in Shreveport, La., cost was the deciding factor in favor of overheads, according to H.S. Robbins, a cost analyst there. The facility, he said, produces 100 to 200 overheads per month, at a cost of about $1 each.

> ”
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> *The cost of slide film recorders is falling, but slides are still limited by technology — they cannot be used in well-lit rooms, for example — and they buck tradition in many firms.*

Cost is not the main reason why the U.S. Department of Energy (DOE) office in Albuquerque, N.M., prefers transparencies to slides, according to David Bagley, a systems analyst there. Bagley said the DOE wanted speed and volume production, both of which he said it gained by using overheads.

Ease of use led Zellweger Uster, Inc., a Charlotte, N.C., computer maker, to prefer transparencies to slides. According to Lenny Furlough, manager of product development, the firm produces 20 to 50 transparencies a month for in-house presentations. Acknowledging that slide technology is becoming less expensive, Furlough said he is giving it a second look.

Of those interviewed, only Paul Holzwarth, audio visual manager for State Mutual Life Assurance Co. of America in Worcester, Mass., said his employer preferred slides to transparencies. State Mutual produces about 7,500 slides annually, he said, using an Autographics computer graphics workstation. Holzwarth said that slides remain in use at State Mutual because they have become a traditional part of a business presentation. Managers, he added, said there is a quality advantage in slides.



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On-line crime suspect system implicated in false arrest

By Charles Babcock
CW New York Bureau

NEWARK, N.J. — A New Jersey woman was arrested, strip searched and jailed on the basis of inadequate information fed into a National Crime Information Center computer, according to a suit filed in U.S. District Court here.

The center is a national clearinghouse for information on suspected criminals. The system is maintained by the Federal Bureau of Investigation in Washington, D.C. A spokesman for the FBI said local police agencies are responsible for what information goes into the system and how it is used in making an arrest.

Elaine Smith of Dover, N.J., was held for eight days in the Morris County jail in July 1983 after a check with the National Crime Information Center indicated a woman with the same name and birth date was wanted in Texas for welfare fraud, said Smith's lawyer, Patrick C. English of Clifton, N.J. Smith had been stopped on a traffic violation, he said.

The target of the Texas search had a different middle name, social security number and physical description from that of the New Jersey Smith, but none of the information except the suspect's weight — 140 lb — had been included in the center's records, English said. His client weighed "less than 100 pounds" at the time of the arrest, he said.

According to English, Smith was arrested a second time and taken "screaming and hysterical" from her place of work by sheriff's deputies in August 1983 for another three-day stay in jail. She was released after it was established she was employed at her job at the time the welfare fraud was committed. The woman said she has never been to Texas, English said.

Classic computer misuse case

English, who has taken the case for the American Civil Liberties Union (ACLU), called it "a classic case of misuse of the computer. [The National Crime Information Center] doesn't have a system sophisticated enough to distinguish between common names."

"It is true of any technological advance. People start depending on the computer and consider it infallible," claimed Deborah H. Karpatkin, staff counsel of the ACLU.

Named as defendants in the suit are: Morris County, N.J., the city and county of Dallas and the state of Texas. The Morris County Prosecutor's office, which sent a representative to accompany sheriff's deputies on the second arrest, is defending the public agencies in the case, but the first assistant prosecutor, Karen Lee Barrett, declined to comment. Her office has not received copies of the suit, she said.

No Social Security number entered

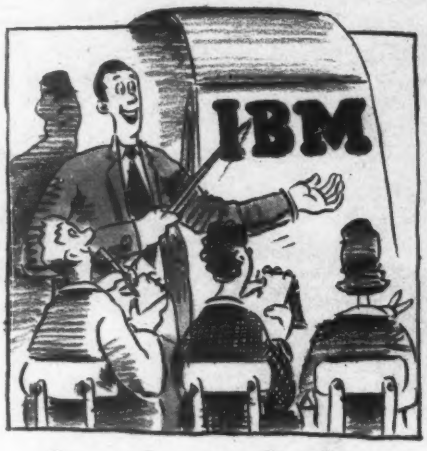
English said he has obtained the documents governing procedures at the National Crime Information Center system. He said it calls for a Social Security number to be entered for each suspect, but none was provided in the Smith case.

The National Crime Information Center uses an IBM 3033 Model S with 12M bytes of memory and a dedicated backup to maintain around-the-clock, on-line files of criminal suspects. About 16,000 law enforcement agencies use the system, accessing it through terminals placed in their offices or at a central law enforcement agency, said a center spokesman.

The center's operating manual, provided to local police agencies, states that finding a "hit," or the name of the party a policeman has stopped in the center's system, "is not probable cause for arrest. A hit is one fact that must be added to others," the center spokesman said.

The suit does not list the amount of the damages sought. New Jersey law requires damages to be left out of the case until it has been heard.





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Software/Expo scheduled for Sept. 17-19

DALLAS — The sixth annual Software/Expo will be held Sept. 17-19 at Infomart here.

Topics to be covered in early conference sessions include the micro-to-mainframe link, software development, project management, graphics, expert systems and micro-based decision support. Later sessions will cover subjects including prototyping, micro uses in business, automated applications development tools, fourth-generation languages, the future of AT&T Unix and strategies for success in the information center.

Thomas M. Nies, chief executive officer of Cincom Systems, Inc. will deliver the keynote address Sept. 17.

Registration fees are $325 for the full conference and $110 for each single day. On-site fees are $50 extra for the full show and $20 for a single day.

More information is available from Software/Expo, Suite 205, 2400 E. Devon Ave., Des Plaines, Ill. 60018.

USPS plans bigger rate discount for nine-digit Zip users

Savings of 1 cent per item expected

By Mitch Betts
CW Washington Bureau

WASHINGTON, D.C. — The U.S. Postal Service (USPS) plans to increase the financial incentive for using nine-digit Zip codes, a move that may prompt hundreds of businesses to convert their computerized mailing lists to the Zip + 4 system.

Today, only about 600 of the nation's biggest mailers use nine-digit Zip codes, but a bigger postal rate discount may increase that figure to 6,000 users, according to James Pehta, vice-president of List Processing Co. (LPC), a software vendor in Glen Ellyn, Ill.

Pehta is also a member of the Mailers Technical Advisory Committee to the Postmaster General.

> *The USPS announcement sends the market a signal that the USPS is firmly committed to Zip + 4.*
>
> — Ronald F. Friedman
> Group 1 Software

In an effort to entice more converts, Postmaster General Paul N. Carlin announced Aug. 8 that the USPS would urge the independent Postal Rate Commission to increase rate incentives for presorted business mail using the nine-digit Zip codes. The present discount is one-half cent per piece.

Although Carlin did not state the amount of the proposed discount, USPS commissioners and industry observers expect the discount to be doubled to about 1 cent per piece.

Could be available by April

Assuming the USPS proposal gets expedited treatment at the Postal Rate Commission, the larger discount could be available by April 1986, Pehta said.

Ronald F. Friedman, vice-president of sales and marketing for Group 1 Software, a division of Computer Network Corp. in Washington, D.C., said the USPS announcement is important because it sends the market a signal that the USPS is firmly committed to Zip + 4.

He said many business mailers had been reluctant to convert because of the apparent ambivalence of USPS management toward the program.

Friedman said the predicted rush of new customers will be a boon for software vendors such as Group 1 and LPC, the dominant vendors in the market, as well as for dozens of service bureaus that use the software to provide conversion services.

The turnkey software packages typically read a company's mailing list — with five-digit Zip codes — and assign each address a nine-digit Zip code from the USPS directory.

Complementary software products can also clean up the mailing list by identifying duplicate and inaccurate addresses.

Attract certain businesses

Pehta and Friedman agreed that the bigger discount will attract businesses with medium-size mailing volumes because the discount will make the payback on conversion investment more attractive, perhaps less than one year for certain firms.

For business mailers, the advantages of Zip + 4 include the USPS discount, targeted delivery and the cleansing effects of the conversion process. For the USPS, Zip + 4 helps to reduce the high labor costs of mail sorting.

In the future, the USPS hopes to have equipment that can read the nine-digit Zip code and then print a bar code on the envelope that can be read by automated sorting machines at destination post offices.

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U.S. lead in disk storage mart threatened by foreigners

Government action needed, report says

By Donna Raimondi
CW Staff

WASHINGTON, D.C. — Foreign competition threatens to topple the U.S.' worldwide preeminence in the disk storage market, according to a government report on the state of the industry.

The U.S. government should establish tax benefits, set realistic export control policies and combat violations of U.S. patents and trademarks as part of a multipronged approach to rectifying the U.S.' slipping hold on the market, according to the U.S. Department of Commerce's report, "A Competitive Assessment of the U.S. Disk Storage Industry."

The study presents the results of an assessment of that industry undertaken by the Commerce Department's Office of Computers and Business Equipment/Science and Electronics. It was written by industry specialists after consultation with various Commerce Department agencies and representatives of industry trade associations, marketing research firms and individual companies in the U.S. and the Far East.

The disk storage industry can be stratified into high-, medium- and low-capacity segments by various parameters, including storage capacity, performance, price and technical complexity, the study said.

Foreign competition — especially from Japanese manufacturers — has been strongest in the market's low-capacity segment, which accounts for 25% of the market's value, the report said. The Japanese have devoted considerable effort to developing optical storage devices, which could lead to their preeminence in the potentially significant high-capacity market segment.

The chief U.S. opportunity lies in the fact that the largest and fastest growing market for storage is in the U.S. To retain their current domestic market share, U.S. firms must turn to automated design and production to ensure high quality and low costs, especially in the low- to medium-storage ranges. Many U.S. manufacturers have moved offshore to remain competitive through lower labor and component costs instead of through automation, the report said.

U.S. companies that manufacture storage devices overseas have inadvertently diffused storage technology knowledge to foreign entrepreneurs, the report said. As a result, countries such as Singapore, Taiwan and Korea have begun to emerge as competitors to the U.S. industry.

If these foreign suppliers are successful in gaining a foothold in the low and medium markets, it is possible that they will ultimately challenge U.S. suppliers at increasingly higher levels of performance and for greater shares of the market's value.

> ”
> *To retain their current domestic market share, U.S. firms must turn to automated design and production to ensure high quality and low costs*

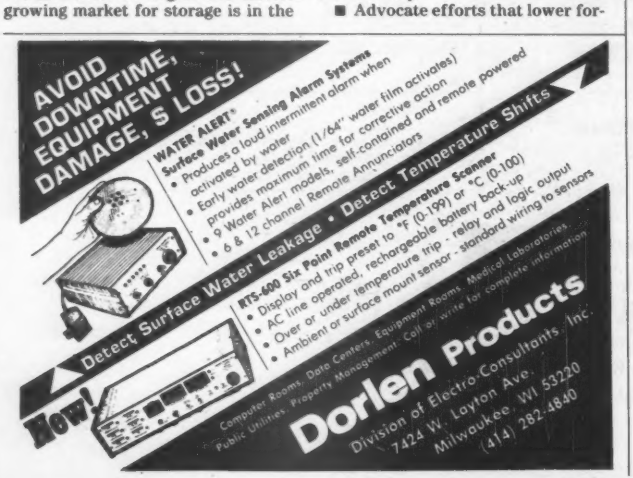
According to the report, a number of policy options arise from the following: the U.S. transfer of technology to foreign competitors, a shortage of engineering talent, the need to maintain leadership in innovation and product technology, the offshore movement of component and disk drive production and the need to automate production and design.

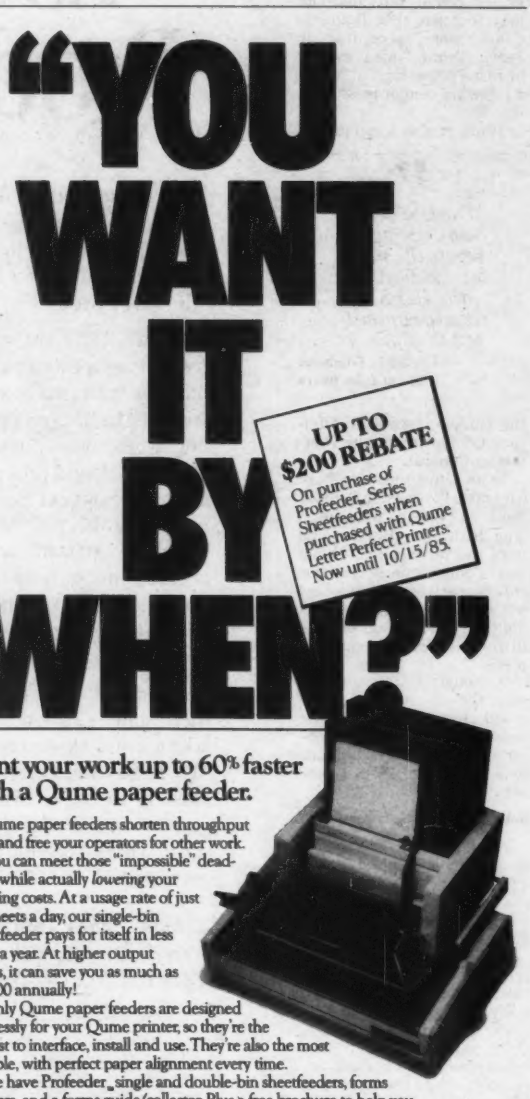
Incentives for the expansion of domestic production and job creation, including tax breaks and subsidies, could result in a slowdown of technology transfer and the movement of U.S. production offshore.

Other tacks the government could take in its effort to guide the course of U.S. industry include the following:

- Encourage research and development activities and increase joint university and private sector programs and private sector R&D consortia.
- Offer tax and other financial incentives to encourage automation of U.S. industry.
- Advocate efforts that lower foreign barriers to free trade and work with U.S. industry to explore other avenues where developing nations can promote domestic high-technology industries without imposing restrictions on U.S. suppliers and without damaging their own interests.
- Continue efforts to ensure that signatory nations adhere to international conventions on intellectual property rights. The government could step up efforts to combat violations of U.S. patents, trademarks and secrets, including the use of trade sanctions where necessary.
- Strike a balance between national security and commercial interest. This could include giving strong support to the Export Administration, which tries to promote better understanding of export control regulations and the licensing process and is establishing a data base on the foreign availability of disk drive products.
- Step up efforts to recruit small- to medium-size and new firms into export promotion programs and encourage the use of export trading companies as a means of penetrating foreign markets. It should also encourage greater dissemination of foreign market research to these firms.

The report — stock number 003-009-00461-6 — is available for $2.50 by writing to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.





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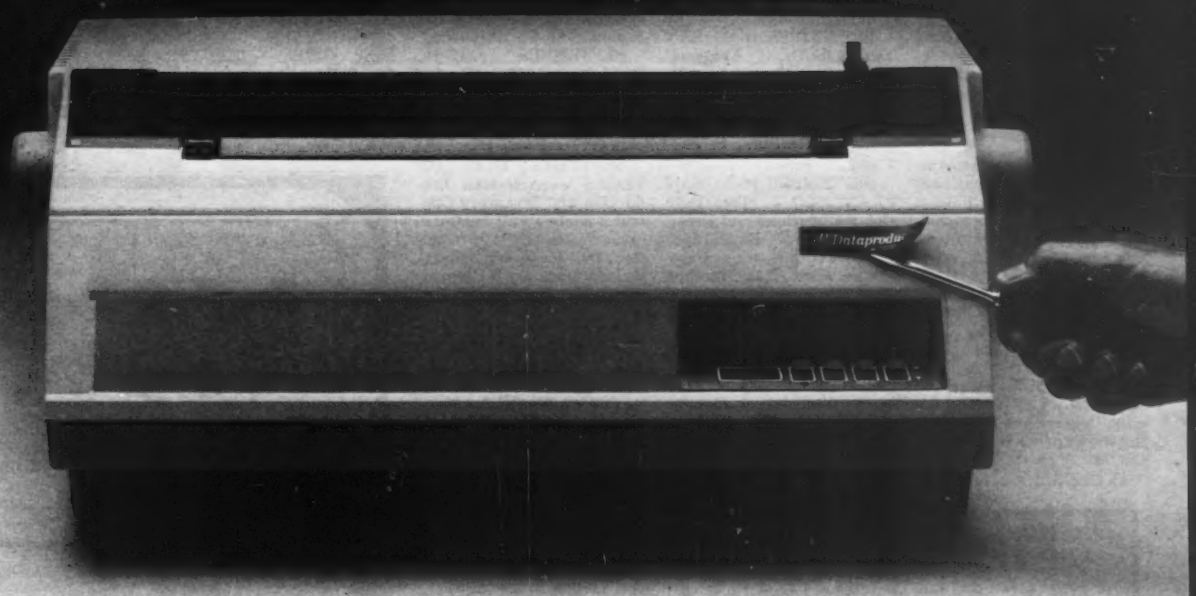
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NEWS

WORLD DIGEST
CW International News Network

TOKYO — Three companies of Sanyo Electric Group — Sanyo Electric, Tokyo Sanyo Electric and Sanyo Electric Trade — along with U.S.-based Icon Systems and Software, recently announced plans to co-develop and market a 32-bit supermicrocomputer. The companies, working together since December 1984, have drawn up the blueprints for the MPS 020-2 model supermicrocomputer. Based on Icon's design concept, the MPS 020-2 features two Motorola, Inc. 68020 microprocessors, processing speeds up to 3 million instructions per second (Mips) and the ability to connect 32 terminals.

Software will run under the AT&T Unix and MS-DOS operating system and will also support IBM 370-era machines. The system is slated for November production and will be manufactured by Tokyo Sanyo Electric, according to the vendor. The MPS 020-2 will cost less than $20,000.

Also being developed is a workstation for the MPS 020 that features a 1,024- by 1,024-pixel monochrome display and graphics processor. Future plans include a 5-Mips Unix machine to support three 32-bit microputers slated for release in 1986 and a 64-Mips machine, capable of linking 32 32-bit systems in 1987.

SYDNEY — The Queensland government's plan to establish its comprehensive Q-Net communications network have upset Telecom Australia, the national government's telecommunications authority. Telecom is worried that a monopoly-breaking precedent could be established because Q-Net will be linked to the public switched telephone network and will effectively become a value-added net operated by the Queensland government. Although Telecom policy allows a common-interest business group to interconnect public net traffic through its private network and then reenter the public net, it does not take the view that departments of a state government have a common interest.

BEIJING — The U.S. Commerce Department announced plans to bring a U.S. consortium of companies here this fall for a conference on telecommunications technology. The Sino-American Conference on the Application of Telecommunications Technology will be held Oct. 28 to Nov. 1. U.S. participants include IBM, AT&T, ITT and RCA Corp.

LONDON — Personal computer users here will face heavy fines or imprisonment if they fail to comply with new legislation governing software copying. A bill passed by Parliament last month makes the copying of software programs, outside the terms of the license agreement, a criminal offense. The act goes into effect on Sept. 15. While the legislation is deemed a step in the right direction, Ian Fraser, chairman of the IBM Personal Computer users group, doesn't think the bill will prove much of a deterrent. "It may make people think twice," he noted, "but when departmental budgets run out, there's a big temptation to use what you've got."

SYDNEY — A government subsidized training program for the unemployed has failed to attract applicants because of a lack of publicity. The scheme, which was the brainchild of the Australian Computer Society, is operated by the society with the assistance of the New South Wales and the Australian national governments.

The program finds and subsidizes employers to take on unemployed people interested in becoming computer programmers. But, according to the scheme's originator, Ormonde Browne, prospective employer-sponsors outnumbered applicants by a staggering 25:1 ratio. The program, which involves an eight-week intensive course, has trained 300 programmers in its five years of operation.

LONDON — IBM Personal Computer ATs are now available off the shelf here, but the British feel like they are getting the machines U.S. buyers do not want. Insiders reported the initial surge of demand in the U.S. for IBM's high-performance AT has not been sustained, and many dealers are having to discount their machines. The Personal Computer XT, on the other hand, is enjoying renewed popularity as buyers find it a much better value than the higher priced AT. The AT glut is being partially attributed to a widespread slump in the industry and to incompatibilities between the AT and other IBM Personal Computers. Some dealers, on the other hand, view it as a general leveling out after initial panic ordering. Therefore, the unwanted machines are finding their way to UK dealers, who are complaining that one out of five of the machines comes with a U.S. power supply.

LONDON — More than 80% of personal computer users feel they are not getting maximum benefit out of their machines, according to a survey just published by Manpower Ltd., a market research firm based here. Users indicated a need for more and better training on their machines. The survey also revealed that, of the 600 people interviewed, only 27% have exclusive use of their Personal Computers, while another 24% said they shared the machine with their secretaries. Some 35% of the respondents said they used IBM Personal Computers, which proved the favorite in industries such as oil, finance and utilities. The report is the first in a series of quarterly surveys to be published by Manpower, at Manpower House, 270-272 High St., Slough, UK.

CALENDAR

WEEK OF SEPT. 15

SEPTEMBER 16-18, SAN FRANCISCO — **Computers in Finance.** Contact: California Datamart, Showplace Sq., San Francisco, Calif. 94103.

SEPTEMBER 16-18, SAN JOSE, CALIF. — **Datastorage '85: An International Forum.** Contact: Cartlidge & Associates, Inc., Suite M-259, 1101 S. Winchester Blvd., San Jose, Calif. 95128.

SEPTEMBER 16-20, CHARLOTTE, N.C. — **Vtam for Practitioners.** Contact: American Data Group, Inc., 3685 Woodbury Drive, Duluth, Ga. 30136.

SEPTEMBER 16-20, MCLEAN, VA. — **Knowledge Engineering 1: Acquiring the Expert's Knowledge.** Contact: Expert Knowledge Systems, Inc., 6313 Old Chesterbrook Road, McLean, Va. 22101.

SEPTEMBER 16-20, NEW YORK — **IMS/DB (DL1) Application Programming.** Contact: Sys-Ed, Computer Education Techniques, Inc., 35 W. 35th St., New York, N.Y. 10001.

SEPTEMBER 16-20, SAN FRANCISCO — **Analysts' Skills Workshop.** Contact: Elise Rabalais, Learmonth & Burchett Management Systems, Inc., Suite 405, 2800 N. Loop W., Houston, Texas 77092.

SEPTEMBER 16-20, SAN FRANCISCO — **Fiber-Optic Communications and Local-Area Networks Exposition.** Contact: Information Gatekeepers, Inc., 214 Harvard Ave., Boston, Mass. 02134.

SEPTEMBER 16-21, CHICAGO — **CICS Command-Level Programming.** Contact: Sys-Ed, Computer Education Techniques, Inc., 35 W. 35th St., New York, N.Y. 10001.

SEPTEMBER 17-18, SAN FRANCISCO — **Computers in Finance — Datamart.** Contact: Alice Gibons, Inter Financial Association, 21 Tamal Vista Blvd., Corte Madera, Calif. 94925.

SEPTEMBER 17-19, BOSTON — **Semicon/East '85.** Contact: Semiconductor Equipment and Materials Institute, Inc., 625 Ellis St., Mountain View, Calif. 94043.

SEPTEMBER 17-19, DALLAS — **1985 Software/Expo.** Contact: Software/Expo, Suite 205, 2400 E. Devon Ave., Des Plaines, Ill. 60018.

SEPTEMBER 18-20, LAS VEGAS — **American Production and Inventory Control Society's Fall Seminar.** Contact: American Production and Inventory Control Society, Inc., 500 W. Annandale Road, Falls Church, Va. 22046.

SEPTEMBER 18-20, LOS ANGELES — **Financial Information Systems: The New Generation.** Contact: National Institute for Management Research Seminars, P.O. Box 3727, Santa Monica, Calif. 90403.

SEPTEMBER 18-20, NEW YORK — **The Unix Operating System Exposition and Conference.** Contact: National Expositions Co., Suite 12A, 49 W. 38th St., New York, N.Y. 10018.

SEPTEMBER 18-27, PARIS — **Salon International D'Informatique, Telematique, Communication, Organisation du Bureau et Bureautique (Sicob).** Contact: Sicob Press Service, 4 Place de Valois, 75001 Paris, France.

SEPTEMBER 19-20, LOS ANGELES — **Data Processing Alternatives for Independent Banks: Service Bureau vs. In-House Systems.** Contact: Alice Gibons, Inter Financial Association, 21 Tamal Vista Blvd., Corte Madera, Calif. 94925.

SEPTEMBER 19-20, NEW YORK — **DOS/VSE for Programmers.** Contact: Sys-Ed, Computer Education Techniques, Inc., 35 W. 35th St., New York, N.Y. 10001.

SEPTEMBER 19-20, NORFOLK, VA. — **Federal ADP and Telecommunications Procurement.** Contact: International Data Corp., Washington Division, Suite 240, 1500 Planning Research Drive, McLean, Va. 22102. Also being held Oct. 3-4 in St. Louis and Oct. 17-18 in Denver.

SEPTEMBER 21-22, PALO ALTO, CALIF. — **Seventh Annual Forth Convention and Banquet.** Contact: Forth Interest Group, P.O. Box 8231, San Jose, Calif. 95155.

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EDITORIAL

Forging better links

Industry leader John Cullinane came up with a new twist to an old joke when he was recently asked what his data base management software customers were asking for these days: "Three things — integration, integration, integration." Although Cullinane was addressing a particular software application, it is a fact that integration is now a byword in the computer industry.

Attention to product and application integration by disparate vendors would clearly serve users handsomely and go a long way toward rescuing elements of the computer industry from impending insolvency. For example, a June 1985 *Business Week*-Louis Harris poll asked DP managers at 600 leading U.S. corporations to explain recent cutbacks in computer-related purchases. Fifty percent of the sample said that companies have acquired so much equipment that they cannot digest what they have, and available hardware has outstripped the networking capability to use it fully.

This evidence sounds a single theme, a lament that organizations have too many computer products that do not work together efficiently. Before DP managers invest in additional equipment, vendors must offer more integration. Most of this integration must, given the reality of the workplace and the marketplace, involve products and applications relating to the IBM Personal Computer. Although many manufacturers have been scrambling for IBM compatibility for years, it is especially heartening to see such firms as Digital Equipment Corp. and Wang Laboratories, Inc., which have fought that trend, increase their links to the Personal Computer.

It was just three weeks ago that DEC offered VAX terminal emulation for the IBM Personal Computer — it was previously available only through third parties — and Wang announced products allowing the Personal Computer to run its word processing software and link its VS minis to the Personal Computer.

These are encouraging signs of a trend that can do nothing but benefit users and one that vendors should continue to pursue with all deliberate speed.

Different strokes

A little more than a year ago at a major trade show, one of Apple Computer, Inc.'s young marketing evangelists hunkered down over a cup of coffee, cast an eye over the field of competitors and pronounced, "Take it from me, Compaq Computer Corp. will be bankrupt by this time next year."

For the record, two weeks ago Compaq checked in with second-quarter profits five times larger than those of a year earlier, making it one of the very few micro companies to register substantial financial gains in the past year. Last we heard from Apple, it was undergoing the latest upper management reorganization. Or was it the latest work force reduction?

Compaq has always been run like a major manufacturing business, an organization that was once described as "a Fortune 500 company waiting to happen." Industry insiders say to expect that to happen by the end of this year. Meanwhile Apple, which has too frequently been run like a religious cult waiting to happen, retains its Fortune 500 status through dint of its early market leadership.

Accordingly, we take our hats off to Compaq while keeping our fingers crossed for Apple.



'Instead of "dump truck," honorable Uncle, please call it "enhanced-efficiency-of-delivery vehicle."

LETTERS

Hacker coverage propagates myth

In the article, "All-star teen hacker's team beat hundreds of systems," [CW, July 8], *Computerworld*'s acceptance of the published bragging of Bill Landreth, a high school dropout hacker, is an interesting phenomenon.

Not only have you given his book a rave review, but your staff writer gave credibility to this juvenile's vaunting by saying that he was an "all-star" and a "major league hacker" and that he accessed "800 computer systems" by presenting them as facts.

Your flattering coverage of a convicted teenage hacker and his book propagates the myth that outside hackers are the greatest threat to computer security.

This, despite the fact that two authoritative studies [CW, June 10 and July 1] have ascertained that insiders are the greatest threat to computer security and not outside hackers.

J. Van Duyn
Loomis, Calif.

***Computerworld** welcomes letters from its readers. Preference will be given to typed, double-spaced letters of 150 words or fewer. Letters may be edited for the purposes of clarity and brevity. Letters should be addressed to Editor, **Computerworld**, Box 880, 375 Cochituate Road, Framingham, Mass. 01701.*

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VIEWPOINT

Management sets tone for project success



THE DATA CENTER
John P. Murray

Information systems development projects usually succeed or fail because of department-level management. It must be firm from the first day of the project cycle, and it must remain firm throughout the project.

How can a project's success or failure be judged? The project should not exceed the allocated funding, it must be completed by the original deadline, and it must deliver what was promised.

The information processing department may be organized so that the requirements for systems success are in place. These include a formal project management system, the use of structured programming and design, peer reviews and a careful testing regimen prior to operational turnover.

Senior management may have a strong interest in the project. Adequate systems and programming staffs may be available. Sufficient test time, with an assurance of a high priority from the data center manager, may be assured. Yet without a true commitment from the DP department management, there is no assurance of success.

For example, consider this common situation: The person leading the information processing portion of the project walks into the office of the department manager and announces that the project, which has been under way for eight months and was scheduled to take 15 months, is two months behind schedule. One week before, during the monthly staff review of project status, this project had been reported as being "essentially on schedule." The department manager now faces a predicament.

Judged by the criteria already cited, this project has failed unless it can somehow be brought back on schedule. If the current assessment is correct, and if nothing is done, the project will take not 15 but 17 months to complete.

> ❞
>
> *Deadlines will not be met unless all involved know that department management expects them to be met. If games are played — such as saying a project is on schedule when in fact it is not — then managers are only encouraging undesirable behavior.*

If additional staff is assigned to complete it within the deadline, the cost of the project will increase. The only hope is to find some method that will end the project on time and within budget without any sacrifice in required results. Considering the current situation, success appears unlikely.

The correct response may be to fire the DP project leader, not for allowing the project to fall behind schedule but for failing to present a factual assessment of its status. Although such draconian action may be justified, it is seldom taken. The usual reality is that the project leader is not dismissed and not even chided.

In fact, such a situation may elicit sympathetic understanding from the department manager. "Yes, I understand, these projects are difficult to manage. No problem, we'll just adjust the schedule by setting a new, let's call it the 'revised,' schedule date. When do you think the project will be finished?"

The answer may be, "Well, gee, that's hard to say, we do have a lot of problems. Why don't you give me a couple of weeks, let me see where we are at that time, and maybe I can give you a better idea." Deadlines will not be met unless all involved know that department management expects them to be met. If games are played — such as saying a project is on schedule when in fact it is not — then managers are only encouraging undesirable behavior.

Allowing such occurrences to develop with apparent impunity sends a signal to the rest of the staff that a lower than agreed on standard of performance will be tolerated. If poor performance is condoned, after a time most of the performance in the department will be poor.

Human nature being what it is, it will not take people very long to realize that failing to meet deadlines will not bring retaliation, or if it does, that retaliation will probably not be harsh. Once that becomes evident, it will be increasingly difficult to enforce project deadlines. At this juncture, deadlines become targets rather than deadlines.

The track record on information processing projects can be improved in any organization. Doing so requires considerable time, effort and attention at all levels. Many new methods and procedures may have to be instituted to make progress. But, unless the manager of the department is willing to exercise firm control and to demand a consistently high level of performance, actual progress will be difficult, if not impossible.

Murray is director of management and information services for American Breeders Service, a DeForest, Wis., division of W. R. Grace & Co. and is the author of Management Information Systems as a Corporate Resource.

Entering the bedazzling bastion of bits and bytes



HUMAN CONNECTION
Jack Stone

The plain truth is that in spite of the enormous strides made in recent years toward simplifying user interfaces, today's computer machinery — be it micro, mini or macro — is still too formidable for many business people.

Aside from the technical intimidation, business users say they feel that the payoff is too meager when compared with the effort exerted in the tedious, often frustrating, learning process.

In my last column, I introduced the views of one data center manager who is developing a scheme for bringing the hard-core computer illiterates — estimated to be 90% of the population, according to one recent survey — into the bedazzling bastion of bits and bytes. Here are more of his thoughts on the matter:

"However hard-working, dedicated and intelligent the novice users may be, learning the productivity systems that run on the smallest of our machines is a bear. What is particularly discouraging is their difficulty in visualizing how the systems will help them achieve personal goals, other then having some data processing experience that embellishes their resumes or merely looking good to their managers.

"To be effective, initial training has to be much more sophisticated than before. Instead of tossing out a jumble of system commands and keyboard procedures, we must figure out ways to relate the learning experience to personal needs. We must think beyond systems that are merely easy to use to those that really meet organizational requirements. Specifically, individuals must perceive systems to be as indispensible to them in their career development as their eyeglasses, fountain pens and briefcases.

"Notebook-class portables, like the Tandy [Corp.] TRS 100/200, offer interesting possibilities in this regard. The base hardware/software complement has the functionality, operational simplicity and reliability that are needed, at least as far as the manufacturer [Kyocera of Japan] went. Most desirable from a training point of view is the invisibility of the operating system and concurrent RAM [random-access memory] residency of programs and data files.

"Of course, one of its greatest virtues is its feather weight — 4 lb — truly making it a machine that can be toted around without fear of breaking some vertebrae — and thus always accessible. Furthermore, during recent months, in addition to providing impressive add-on hardware, the independent vendors have really gone to town with software enhancements aimed specifically at improving the productivity goals of the individual.

"Let me cite some examples. Traveling Software, Inc. [in Seattle] offers independent modules for managing appointments, calendar and travel expenses. For the sales folks, there is a package for handling sales data, and for the team leaders, there is one for project management.

"The firm even sells a relational data base management system that allows the linking of files and the creation of custom reports and screen displays, plus a built-in spreadsheet-like capability. Not bad considering that user-accessible RAM is limited to 29K bytes.

"Also impressive are the products of Chattanooga Systems [in Chattanooga, Tenn.]. They specialize in personal programs that typically occupy less than about 4K bytes of RAM and merchandise quite a collection on one cassette tape: a text formatter, a [26-by 99-cell] spreadsheet, a list manager, a sort, a calculator, a trip expense accountant — even a personalized letter generator.

"Where cassette storage is too cumbersome — in the majority of cases, to be sure — the industry is providing read-only memory in pop-in program cartridges. Where the applications truly require bulk storage, one can obtain battery-operated [3½-lb] disk drives that handle 300K-byte-plus minidiskettes.

"Most important, one independent [vendor] has come forth with a beautiful package for effecting the transition to the IBM Personal Computer from the noncompatible Kyocera. Instead of downsizing MS-DOS or its ilk to a notebook machine, Telecommuter software from Sigea Systems [in Weston, Mass.] has [expanded] Kyocera operating system features and provided a simple hookup to transfer files. In this way, business users find themselves in the Personal Computer environment without fuss or bother.

"Oh, I'm aware of the cost problem with these small machines, such as RAM that is about 30 times the cost of add-on RAM for our Personal Computers. On the other hand, because overall cost is low, particularly when compared with the cost and effectiveness of more conventional training, the idea is appealing."

Stone is a Washington, D.C.-based independent management consultant, educator and writer, specializing in DP human communications and personnel development.

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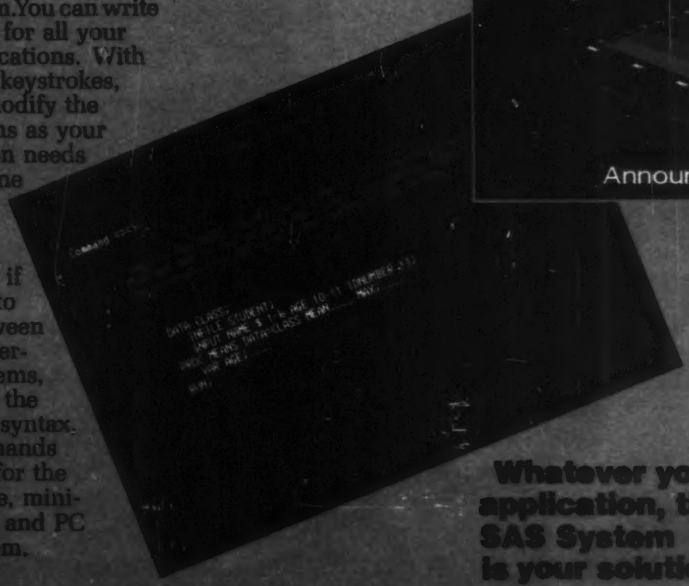
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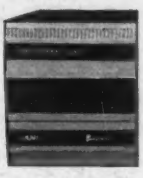
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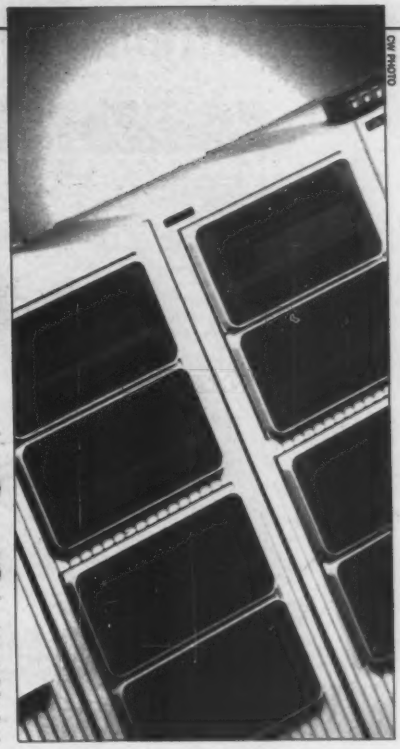


INFOTRON SYSTEMS

Hardware Roundup

By Tom Henkel CW Staff

A look at 212 systems from 28 vendors

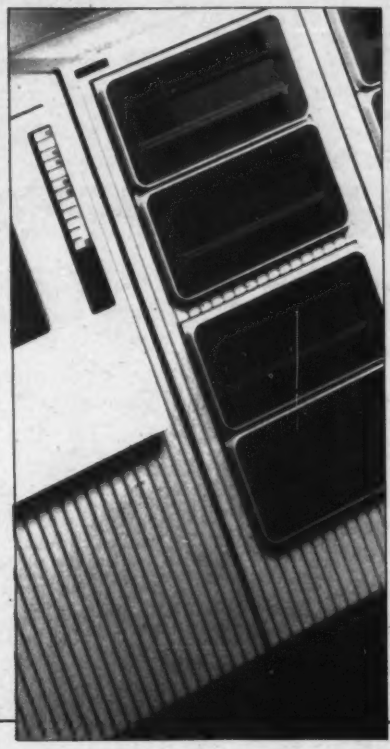


CW PHOTO

For mainframe users, the past year was special. Like the rare times when all the planets are in alignment, most of the major mainframe makers participated in an event that happens roughly every four or five years — they made major enhancements to their top-end product lines.

As is tradition, IBM started the round of mainframe announcements by unveiling the long-awaited Sierra line — two systems called the 3090 Model 200 and Model 400. National Advanced Systems Corp., Burroughs Corp. and Honeywell, Inc. quickly followed suit by announcing the two-model AS/XL, the three-model A15 and the five-model DPS 90 product lines, respectively.

Sperry Corp. got into the act with enhancements to its 1100/90 series mainframes aimed at making those systems perform better in scientific environments. The three remaining domestic makers did not enhance their top-end products, however. Control Data Corp. rested on the laurels of its Cyber 180 series enhancements of a year earlier, and Amdahl Corp. stuck with the 5880. NCR Corp. also chose to keep its current top-end product line.



The superminicomputer marketplace of the past year was volatile, a combination of boom and bust. Slumping supermini sales and fallout from a massive buying trend over the past two years spawned a rash of corporate layoffs that hit even the most stalwart firms like Wang Laboratories, Inc. and Data General Corp. But before the slump in supermini sales put the damper on new product introductions, Digital Equipment Corp. and Prime Computer, Inc. unveiled top-end superminis — the VAX 8600 and the 9955, respectively.

It was the year of parallel processing — the concept of using multiple CPUs operating concurrently to equal, or in some cases surpass, the performance of larger mainframe processors. Parallel systems architecture, although by no means a new concept, became the preferred system design for several companies. Start-up Encore Computer Corp. unveiled its Multimax parallel system early this summer. Intel Corp. also this summer began deliveries of its IPSC hypercube system announced last September. And Perkin-Elmer Corp. beefed up its commitment to parallel processing by unveiling two high-end parallel systems — the 3260MPS and the 3230MPS.

> ***It was the year of parallel processing — that is, using multiple CPUs operating concurrently to equal the performance of larger mainframe processors.***

Perhaps the underlying impact of activity in the mainframe and supermini markets was the continuation of an ongoing trend whereby the already blurred distinctions between classes of computer systems becomes more clouded each year.

For example, the high-end mainframes announced by IBM, Burroughs and Honeywell appear to tread on ground typically held by supercomputer vendors such as Cray Research, Inc. and CDC.

In response to the ever-evolving computer marketplace, this year's three-part Hardware Roundup is a little different.

This first installment, mainframes and superminis, remains for the most part in its usual format. But because of the growing number of superminicomputer-class processors, those that appear to have a specialized focus will appear in next week's issue.

Included in this group of specialized systems are transaction processing systems, such as those manufactured by Tandem Computers, Inc. and Stratus Computer, Inc., and superminicomputers that appear to be geared to scientific/engineering applications, artificial intelligence and so on. The determination of which systems would appear in this group is admittedly subjective, since many vendors claim their systems can function in either the commercial or the scientific environment. Also, for the first time, next week's installment of the Hardware Roundup will include information about supercomputers.

The final segment of the Hardware Roundup will focus on traditional 16-bit minicomputers and the new breed of so-called supermicrocomputers. It will also address, in a somewhat abbreviated fashion, traditional microcomputers. The intent of this section is to address those microprocessor-based systems that would most likely fit into a business environment, as opposed to a home setting.

Furthermore, *Computerworld* offers the usual provisos on relative performance and million instructions per second throughput ratings. These ratings are provided in an attempt to put the systems in the Hardware Roundup into perspective by offering approximations of their power.

These numbers are not intended to be used as a buyer's guide. Clearly, many factors can influence the actual performance a user will experience with a given computer system.

Finally, CW does not endorse any product listed in the Hardware Roundup.

HARDWARE ROUNDUP

IBM mainframes and plug compatibles

IBM

Characteristics \ System	3083 Model CX	3083 Model EX	3083 Model BX	3083 Model JX	3081 Model GX	3081 Model KX	3084 Model QX	3090 Model 200	3090 Model 400
Relative Performance[1]	148	197	280	364	340	725	1,284	1,320	2,391
Mips[2]	2.4	3.3	6	8.4	12.5	16.3	29.1	29.3	52.7
Memory Size in Bytes (Minimum-Maximum)	8M-32M	8M-16M	8M-32M	8M-32M	16M-64M	16M-64M	32M-128M	64M	128M[3]
Purchase Price[4] (Memory Size)	$805,000 (8M)	$895,000 (8M)	$125,500 (16M)	$185,000 (32M)	$219,000 (16M)	$261,000 (16M)	$8,010,000 (64M)	$4,600,000 (64M)	$9,300,000 (128M)
Lease Price[4] (Lease Term)	None	None	None	None	None	None	None	None	None
Machine Cycle Time (Nsec)	24	24	24	24	24	24	24	18.5	18.5
Channels (Minimum-Maximum)	8-16	8-16	8-24	8-24	16-32	16-32	48	32-48	64-96
Cache (Buffer) Size	16K	16K	32K	64K	64K[5]	64K[5]	64K	128K	256K
Dual Architecture	No	No	No	No	No	No	No	No	No
Price per 1M Byte of Main Memory	$12,520	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. For the processor only.
4. Available through IBM Credit Corp.
5. The 3081 processors employ dyadic, or two closely coupled, processors. The buffer size listed is per processor.

CW Chart

IBM

Characteristics \ System	4361 Model 3	4361 Model 4	4361 Model 5	4381 Model 1	4381 Model 2	4381 Model 3
Relative Performance[1]	22	43	94	100	137	289
Mips[2]	0.38	0.79	1.14	2.1	2.7	4.8
Memory Size in Bytes (Minimum-Maximum)	2M-12M	2M-12M	2M-12M	4M-16M	4M-16M	8M-32M
Purchase Price[3] (Memory Size)	$126,900 (2M)	$126,900 (2M)	$200,000 (2M)	$370,000 (4M)	$500,000 (4M)	$340,400 (8M)
Lease Price[3] (Lease Term)	None	None	None	None	None	None
Machine Cycle Time (Nsec)	100 (Per 4 bytes)	100 (Per 4 bytes)	100 (Per 4 bytes)	68 (Per 4 bytes)	68 (Per 4 bytes)	68 (Per 4 bytes)
Channels (Minimum-Maximum)	1-3	1-4	3-6	8-12	8-12	8-16
Cache (Buffer) Size	8K	8K	16K	8K	32K	64K
Dual Architecture	No	No	No	No	No	No
Price per 1M Byte of Main Memory	$7,500	$7,500	$7,500	$10,000	$10,000	$10,000

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3. For the processor only.
4. Available through IBM Credit Corp.

CW Chart

IBM

Characteristics \ System	System/38 Model 4	System/38 Model 6	System/38 Model 18	System/38 Model 20	System/38 Model 40	8130A	8130B	8140	8150A	8150B
Relative Performance[1]	13	20	26	41	54	12	18	30	48	48
Mips[2]	0.2	0.3	0.57	0.67	0.88	0.2	0.3	0.36	0.86	0.86
Memory Size in Bytes (Minimum-Maximum)	1M-2M	2M-6M	4M-8M	4M-8M	8M-16M	768K-1M	768K-2M	768K-2M	1M-3M	2M-5M
Purchase Price (Memory Size)	$39,140[3] (1M)	$64,000[4] (2M)	$120,000[5] (4M)	$145,000[6] (4M)	$205,000 (8M)	$19,040[7] (768K)	$37,600[8] (1M)	$60,000[9] (1M)	$82,500 (2M)	$115,000 (2M)
Lease Price (Lease Term)	None	None	None	None	None	None	None	None	None	None
Machine Cycle Time (Nsec)	1,100 (Per 4 bytes)	400 (Per 4 bytes)	400 (Per 4 bytes)	400 (Per 4 bytes)	166.5 (Per 4 bytes)	1,500	1,500	800	Not available	Not available
Channels (Minimum-Maximum)	1	1	1	1	1	None	None	None	None	None
Cache (Buffer) Size	None	None	None	None	None	None	None	None	None	None
Dual Architecture	No	No	No	No	No	No	No	No	No	No
Price per 1M Byte of Main Memory	$7,500	$7,500	$7,500	$7,500	$7,500	$10,000	$10,000	$10,000	$10,000	$10,000

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2. Million instructions per second; CW estimates.
3. For a Model 441 processor.
4. For a Model 681 processor.
5. For a Model AG1 processor.
6. For a Model CY1 processor.
7. For a Model A21 processor.
8. For a Model B23 processor.
9. For a Model B72 processor.

CW Chart

HARDWARE ROUNDUP

Amdahl Corp.

Characteristics \ System	5840	5850	5860	5867	5868	5870	5890
Relative Performance[1]	378	522	638	900	880	1,197	1,101
Mips[2]	8.4	11.6	14	22.0	22.0	26.6	26.6
Memory Size in Bytes (Minimum-Maximum)	16M-64M	16M-64M	16M-64M	24M-56M	32M-128M	32M-96M	32M-128M
Purchase Price[3] (Memory Size)	$1,550,000 (16M)	$1,850,000 (16M)	$2,150,000 (16M)	$2,850,000 (24M)	$3,410,000 (32M)	$3,470,000 (32M)	$3,930,000 (32M)
Lease Price (Lease Term)	$61,635 (4 Year)	$85,920 (4 Year)	$106,120 (4 Year)	$138,185 (4 Year)	$166,120 (4 Year)	$173,345 (4 Year)	$197,415 (4 Year)
Machine Cycle Time (Nsec)	23.25	23.25	23.25	23.5	23.5	23.25	23.25
Channels (Minimum-Maximum)	16-32	16-32	16-32	16-32	32-48	16-32	32-48
Cache (Buffer) Size[4]	64K	64K	64K	64K	64K	128K	128K
Bus Architecture	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory[5]	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500	$12,500

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2. Million instructions per second; vendor claims.
3. Includes processor, console, power supply and all prerequisites.
4. The 5860 has two 32K-byte buffers. The 5870 and 5890 have four 32K-byte buffers.
5. Available in 8M-byte increments costing $100,000.

CW Chart

National Advanced Systems Corp.

Characteristics \ System	AS/9023	AS/9043	AS/9053	AS/9063	AS/9083	AS/9040	AS/9050	AS9060	AS/9070	AS/9080	AS/XL Model 60	AS/XL Model 80
Relative Performance[1]	148	330	720	988	750	224	458	525	754	975	1,312	2,437
Mips[2]	2.9	5.24	6.52	8.43	15.2	7.2	9	11.2	16.2	20	28	50
Memory Size in Bytes (Minimum-Maximum)	4M-32M	8M-32M	8M-32M	8M-32M	16M-32M	8M-48M	8M-48M	16M-64M	16M-64M	16M-64M	32M-256M	64M-256M
Purchase Price[3] (Memory Size)	$730,500 (16M)	$1,092,000 (16M)	$1,492,000 (16M)	$1,880,000 (16M)	$2,871,000 (16M)	$1,402,000 (8M)	$1,794,000 (8M)	$2,156,000 (16M)	$3,041,000 (16M)	$3,878,000 (16M)	$4,840,000 (64M)	$8,470,000 (64M)
Lease Price (Lease Term)	$13,310 (3 Year)	$19,460 (3 Year)	$30,885 (3 Year)	$40,720 (3 Year)	$67,130 (2 Year)	$34,390 (3 Year)	$43,585 (3 Year)	$52,075 (2 Year)	$71,485 (2 Year)	$83,980 (2 Year)	Not available	Not available
Machine Cycle Time (Nsec)	40	40	40	35	35	38	38	30	38	30	Not available	Not available
Channels (Minimum-Maximum)	8-24	8-24	8-24	8-24	16-32	8-24	8-24	16-24	16-32	16-48	32-64	32-64
Cache (Buffer) Size	32K	32K	64K	64K	128K	84K	256K	256K	128K[4]	512K[4]	256K	512K[4]
Bus Architecture	No	No	No	No	No	No	No	No	No	No	No	No
Price per 1M Byte of Main Memory[5]	$11,800	$11,800	$11,800	$11,800	$11,800	$11,800	$11,800	$11,800	$11,800	$11,800	$11,800	$11,800

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. Includes processor, console, power supply and all prerequisites.
4. Cache memory per CPU.
5. Minimum additional memory configuration on the AS/9000, AS/9000 and AS/XL series processors is 8M bytes costing $95,000.

CW Chart

National Advanced Systems Corp.

Characteristics \ System	AS/6620	AS/6630	AS/6650	AS/6660
Relative Performance[1]	74	100	125	140
Mips[2]	1.6	2	2.4	2.8
Memory Size in Bytes (Minimum-Maximum)	8M-16M	8M-16M	8M-16M	8M-16M
Purchase Price[3] (Memory Size)	$255,000 (8M)	$341,500 (8M)	$417,500 (8M)	$475,000 (8M)
Lease Price (Lease Term)	$9,545 (2 Year)	$11,785 (2 Year)	$15,265 (2 Year)	$17,435 (2 Year)
Machine Cycle Time (Nsec)	60	60	50	43
Channels (Minimum-Maximum)	5-8	5-8	5-12	5-13
Cache (Buffer) Size	64K	64K	64K	64K
Bus Architecture	No	No	No	No
Price per 1M Byte Of Main Memory[4]	$8,000	$8,000	$8,000	$8,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. Includes processor, console, power supply and all prerequisites.
4. AS/6000 series systems are available with a minimum additional memory configuration of 8M bytes costing $64,000.

CW Chart

HARDWARE ROUNDUP

IBM mainframes and plug compatibles

Global Ultimacc Systems, Inc.

Characteristics \ System	USX40	USX43	USX44	USX46 Model 2
Relative Performance[1]	32	54	58	97
Mips[2]	0.65	1.2	1.2	2.2
Memory Size in Bytes (Minimum-Maximum)	1M-8M	2M-16M	2M-16M	4M-16M
Purchase Price (Memory Size)	$18,750 (2M)	$37,500 (4M)	$37,500 (4M)	$90,625 (8M)
Lease Price[3] (Lease Term)	$918 (2 Year)	$1,836 (2 Year)	$1,836 (2 Year)	$4,436 (2 Year)
Machine Cycle Time (Nsec)	100	100	100	100
Channels (Minimum-Maximum)	3-8	3-12	6-16	6-32
Cache (Buffer) Size	16K	32K	32K	64K
Bus Architecture	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory[4]	$3,700	$3,700	$3,700	$3,700

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. For a purchase/ lease. Operating leases are also available.
4. Available in 2M-byte configurations costing $7,500.

CW Chart

IPL Systems, Inc.

Characteristics \ System	4443	4446	4480	4490
Relative Performance[1]	45	70	90	135
Mips[2]	1	1.5	1.6	2.7
Memory Size in Bytes (Minimum-Maximum)	2M-8M	2M-16M	2M-16M	6M-16M
Purchase Price[3] (Memory Size)	$93,500 (2M)	$165,000 (4M)	$195,800 (4M)	$443,000 (8M)
Lease Price (Lease Term)	$5,625 (2 Year)	$9,210 (2 Year)	$9,400 (2 Year)	$21,450 (2 Year)
Machine Cycle Time (Nsec)	50	50	50	50
Channels (Minimum-Maximum)	3-6	6	6	10
Cache (Buffer) Size	8K	24K	24K	48K[4]
Bus Architecture	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$8,250	$8,250	$8,250	$8,800

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; vendor claims.
3. Includes processor, console, power supply and all prerequisites.
4. Has two 24K-byte buffers.

CW Chart

Nixdorf Computer Corp.

Characteristics \ System	8890/CP[1]	8890 Model 12	8890 Model 32	8890 Model 52	8890 Model 72
Relative Performance[2]	17	17	17	30	41
Mips[3]	0.25	0.25	0.25	0.5	0.7
Memory Size in Bytes (Minimum-Maximum)	1M	1M-2M	2M-4M	2M-8M	4M-8M
Purchase Price[4] (Memory Size)	$99,950 (1M)	$28,750 (1M)	$146,500 (2M)	$53,500 (2M)	$85,500 (4M)
Lease Price (Lease Term)	$2,900 (3 Year)	$836 (3 Year)	$1,360 (3 Year)	$1,550 (3 Year)	$2,475 (3 Year)
Machine Cycle Time (Nsec)	200	200	200	200	200
Channels[5] (Minimum-Maximum)	2	2	2	4	5
Cache (Buffer) Size	None	None	None	None	64K
Bus Architecture	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte Of Main Memory	$6,350	$6,350	$6,350	$6,350	$6,350

1. The 8890/CP is a preconfigured system consisting of a CPU, four terminals, two disk drives (in either 200M- or 250M-byte capacities), a 300 line/min printer, a streaming tape drive, four communications lines, Nixdorf's Nidos/VSE Release 2 operating system, a terminal control program, a Cobol compiler and a Multi Host Facility.
2. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
3. Million instructions per second; vendor claims.
4. For the processor, power supply, console and all prerequisites.
5. In addition to channels for attachment of IBM peripherals, Nixdorf 8890 processors are equipped with microprocessor-controlled I/O processors to which Nixdorf peripherals can be attached. There are eight such channels available on the Model 70, six on the Model 50 and four on the Model 30, according to the vendor.

CW Chart

Cambex Corp.

Characteristics \ System	1636 Model 10	1641 Model 1	1641 Model 11	1651 Model 1
Relative Performance[1]	36	40	57	80
Mips[2]	0.60	0.72	0.90	1
Memory Size in Bytes (Minimum-Maximum)	1M-8M	2M-16M	2M-16M	2M-16M
Purchase Price[3] (Memory Size)	$98,500 (1M)	$130,000 (2M)	$155,000 (2M)	$215,000 (4M)
Lease Price (Lease Term)	$5,500 (2 Year)	$7,200 (2 Year)	$8,950 (2 Year)	$11,800 (2 Year)
Machine Cycle Time (Nsec)	50	50	50	50
Channels (Minimum-Maximum)	3-5	3-5	3-8	3-8
Cache (Buffer) Size	8K	8K	8K	8K
Bus Architecture	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$7,500	$7,500	$7,500	$7,500

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. Includes processor, console, power supply and all prerequisites.

CW Chart

HARDWARE ROUNDUP

Other vendors' mainframes

Honeywell, Inc.

Characteristics \ System	DPS 88/41	DPS 88/42	DPS 88/42T	DPS 88/81	DPS 88/82	DPS 88/82T	DPS 90/91	DPS 90/92	DPS 90/92T	DPS 90/93	DPS 90/94
Relative Performance[1]	219	316	319	326	476	479	466	661	667	1,361	1,876
Mips[2]	4.8	4.8	4.8	7.2	13	13	10.8	19.4	19.4	28	36.7
Memory Size in Bytes (Minimum-Maximum)	16M-64M	16M-128M	16M-128M	16M-64M	16M-96M	16M-128M	32M-128M	32M-128M	64M-256M	64M-256M	64M-256M
Purchase Price (Memory Size)	$1,850,000 (16M)	$2,950,000 (16M)	$3,700,000 (16M)	$2,850,000 (16M)	$4,050,000 (16M)	$4,800,000 (16M)	$3,950,000 (32M)	$5,000,000 (32M)	$6,250,000 (64M)	$7,300,000 (64M)	$8,350,000 (64M)
Lease Price (Lease Term)	$94,750 (4 Year)	$103,288 (4 Year)	$129,860 (4 Year)	$91,280 (4 Year)	$141,080 (4 Year)	$172,800 (4 Year)	$183,721 (4 Year)	$232,588 (4 Year)	$290,688 (4 Year)	$339,535 (4 Year)	$388,372 (4 Year)
Machine Cycle Time (Nsec)	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available	Not available
Channels (Minimum-Maximum)	10-40	10-40	10-40	10-40	10-40	10-40	10-48	10-48	10-48	10-48	10-48
Cache (Buffer) Size	64K	64K	64K	64K	128K	128K	32K	64K	64K	96K	128K
Bus Architecture	No	No	No	No	No	No	No	No	No	No	No
Price per 1M Byte of Main Memory	$16,250	$16,250	$16,250	$16,250	$16,250	$16,250	$12,500	$12,500	$12,500	$12,500	$12,500

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.

CW Chart

Honeywell, Inc.

Characteristics \ System	DPS 8/47	DPS 8/49	DPS 8/52	DPS 8/62	DPS 8/70
Relative Performance[1]	41-72	61-208	81-320	82-250	107-383
Mips[2]	0.73-1.2	1.1-4.5	1.1-4.9	1.2-5.9	1.8-7.2
Memory Size in Bytes (Minimum-Maximum)	4M-32M	4M-32M	4M-32M	4M-32M	4M-64M
Purchase Price (Memory Size)	$153,000 (2M)	$253,000 (4M)	$450,000 (4M)	$550,000 (4M)	$700,000[3] (4M)
Lease Price (Lease Term)	$7,400 (4 Year)	$10,000 (4 Year)	$21,062 (5 Year)	$25,804 (5 Year)	$38,044 (5 Year)
Machine Cycle Time (Nsec)	Not available	Not available	Not available	Not available	Not available
Channels (Minimum-Maximum)	20	30	54	54	108
Cache (Buffer) Size	32K	32K	32K	32K	32K
Bus Architecture	No	No	No	No	No
Price per 1M Byte of Main Memory	$10,000	$10,000	$20,000	$20,000	$20,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. For the processor only. Each of the models in the DPS 8 line can accommodate multiple processors.

CW Chart

Honeywell, Inc.

Characteristics \ System	DPS 6/85	DPS 6/95	DPS 7/35E	DPS 7/65E
Relative Performance[1]	73	110	28	76
Mips[2]	1.2	1.8	0.5[3]	1.36[3]
Memory Size in Bytes (Minimum-Maximum)	2M-4M	2M-16M	1M-6M	1M-6M
Purchase Price[4] (Memory Size)	$57,000 (2M)	$104,900 (2M)	$85,200[5] (1M)	$215,700[5] (2M)
Lease Price (Lease Term)	None	None	$2,986 (5 Year)	$7,759 (5 Year)
Machine Cycle Time (Nsec)	300	125	330	140
Channels (Minimum-Maximum)	16-64	4-128	5-9	8-8
Cache (Buffer) Size	8K	8K	None	None
Bus Architecture	Yes	Yes	No	No
Price per 1M Byte of Main Memory	$7,000	$8,000	$10,000	$10,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; vendor claims.
3. CW estimates.
4. Includes processor, console, 80M-byte disk drive, 5¼-in. diskette drive and 5¼-in. disk drive.
5. Includes a unit record processor, console, keyboard, remote maintenance adapter and a diskette unit. The DPS 7/35E configuration includes two I/O channels; the DPS 7/65 includes four I/O channels.

CW Chart

Sperry Corp.

Characteristics \ System	System 80 Model 4	System 80 Model 6	System 80 Model 8	System 11UP	System 11MP	1100/71 H2	11/70 H2	1100/81 SV	1100/91	1100/92SV	1100/92	1100/93	1100/94
Relative Performance[1]	14	21	42	30	52	97	176	233	345	480	644	920	1,166
Mips[2]	0.20	0.37	0.70	0.5	0.9	1.6	2.9	5.5	7.5	10.2	14	20	26
Memory Size in Bytes (Minimum-Maximum)	512K-4M	512K-4M	1M-8M	4M-16M	8M-16M	2M-16M	4M-32M	8M-16M	8M-64M	8M-32M	8M-64M	8M-64M	8M-64M
Purchase Price[3] (Memory Size)	$66,082 (512K)	$85,905 (512K)	$123,900 (1M)	$77,644 (4M)	$114,841 (4M)	$301,060 (2M)	$509,370 (4M)	$2,005,962 (8M)	$2,435,811 (8M)	$2,896,972 (8M)	$3,620,221 (16M)	$4,818,631 (16M)	$6,447,041 (32M)
Lease Price (Lease Term)	$1,650[4] (5 Year)	$2,145[4] (5 Year)	$2,354 (5 Year)	$2,329 (5 Year)	$3,445 (5 Year)	$5,720 (5 Year)	$9,675 (5 Year)	$37,110 (5 Year)	$45,062 (5 Year)	$53,594 (5 Year)	$66,974 (5 Year)	$89,145 (5 Year)	$119,270 (5 Year)
Machine Cycle Time (Nsec)	180	180	124	108	108	116	116	30	30	30	30	30	30
Channels[5] (Minimum-Maximum)	1 or 3	1 or 3	1-8	Variable	Variable	24	24	80	80	120	120	180	240
Cache (Buffer) Size	None	None	None	None	None	32K	64K	64K	64K	128K	128K	192K	256K
Bus Architecture	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Price per 1M Byte of Main Memory	$2,956	$2,956	$14,400	$7,500	$7,500	$12,160	$12,160	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; vendor claims.
3. Includes processor, console, power supply and all prerequisites.
4. Available through Sperry. All other lease prices are available through Sperry Credit Corp.
5. Systems are available with a disk cache memory ranging from 32K bytes to 1M bytes.

CW Chart

HARDWARE ROUNDUP

Other vendors' mainframes

NCR Corp.

Characteristics \ System	V-8635	V-8645[1]	V-8655[1]	V-8665[2]	V-8675[3]	V-8685[4]	V-8695[4]
Relative Performance[6]	85	104-111	97-124	134-156	178-201	280-300	375-401
Mips[7]	1	1.9	2	2.8	3.7	5.5	7.3
Memory Size in Bytes (Minimum-Maximum)	4M-16M	4M-16M	8M-32M	8M-32M	8M-32M	12M-48M	16M-64M
Purchase Price[8] (Memory Size)	$455,000 (4M)	$695,000 (4M)	$970,000 (8M)	$1,215,000 (8M)	$1,455,000 (8M)	$2,190,000 (12M)	$2,895,000 (16M)
Lease Price[9] (Lease Term)	$14,667 (3 Year)	$22,375 (3 Year)	$29,628 (3 Year)	$37,442 (3 Year)	$44,370 (3 Year)	$66,622 (3 Year)	$88,878 (3 Year)
Machine Cycle Time (Nsec)	38[10]	38[10]	38[10]	38[10]	38[10]	38[10]	38[10]
Channels[11] (Minimum-Maximum)	16-32[12]	16-32	16-64	16-64	16-64	32-64	32-64
Cache (Buffer) Size	32K	128K	64K	160K	256K	384K	512K
Bus Architecture	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$16,200	$16,200	$16,200	$16,200	$16,200	$16,200	$16,200

1. Dual processor.
2. Three-processor system.
3. Four-processor system.
4. Six-processor system.
5. Eight-processor system.
6. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures, and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
7. Million instructions per second; vendor claims.
8. Includes processor, console, power supply and all prerequisites.
9. Includes maintenance.
10. For each processor.
11. Each I/O channel is capable of supporting up to four strings of devices, according to the vendor.
12. Up to 64 channels are available if an optional dynamic channel director is used.

CW Chart

NCR Corp.

Characteristics \ System	8300	8400	V-8565-II	V-8565-IIE	V-8575-II[1]	V-8595-II[1]
Relative Performance[2]	7	15	17	34	34	68
Mips[3]	0.15	0.30	0.25	0.42	0.61	0.77
Memory Size in Bytes (Minimum-Maximum)	1M-4M	1M-4M	1M-4M	2M-8M	4M-8M	4M-16M
Purchase Price[4] (Memory Size)	$20,340 (1M)	$33,765 (1M)	$54,000 (1M)	$70,000 (2M)	$123,000 (4M)	$170,000 (4M)
Lease Price[5] (Lease Term)	$744 (3 Year)	$1,506 (3 Year)	$3,974 (3 Year)	$7,017 (3 Year)	$8,904 (3 Year)	$15,617 (3 Year)
Machine Cycle Time (Nsec)	150	150	56	56	56[6]	56[6]
Channels[7] (Minimum-Maximum)	2-210	2-210	1-6[6]	0-8[6]	0-8[6]	0-8[6]
Cache (Buffer) Size	None	None	None	None	None	None
Bus Architecture	Yes	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$6,500	$6,500	$7,500	$7,500	$7,500	$7,500

1. Dual processor.
2. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
3. Million instructions per second; vendor claims.
4. Includes processor, console, power supply and all prerequisites.
5. For each processor.
6. Each I/O channel is capable of supporting up to four strings of devices, according to the vendor.
7. Up to 64 channels are available if an optional dynamic channel director is used.
8. Includes maintenance.

CW Chart

Control Data Corp.

Characteristics \ System	Cyber/180 810	Cyber/180 830	Cyber/180 830 (Dual CPU)	Cyber/180 840	Cyber/180 850	Cyber/180 860	Cyber/180 860 (Dual CPU)	Cyber/180 990	Cyber/180 990 (Dual CPU)
Relative Performance[1]	0.59	85	170	230	340	575	780	2,485[2]	3,730[2]
Mips[3]	0.8	1.2	2	3.7	5.6	8.5	15.2	42[2]	63[2]
Memory Size in Bytes[4] (Minimum-Maximum)	2M-32M	2M-32M	2M-32M	16M-128M	16M-128M	16M-128M	16M-128M	8M-32M	8M-32M
Purchase Price (Memory Size)	$125,000 (2M)	$180,000 (2M)	$290,000 (2M)	$760,000 (16M)	$1,115,000 (16M)	$1,575,000 (16M)	$2,430,000 (16M)	$3,350,000 (8M)	$5,100,000 (8M)
Lease Price (Lease Term)	$7,105 (1 Year)	$9,435 (1 Year)	$14,800 (1 Year)	$31,235 (1 Year)	$46,170 (1 Year)	$60,609 (1 Year)	$92,130 (1 Year)	$134,000 (1 Year)	$204,000 (1 Year)
Machine Cycle Time (Nsec)	50	50	50	56	16	16	16	16	16
Channels (Minimum-Maximum)	8-16	8-16	8-16	12-24	12-24	12-24	12-24	12-24	12-24
Cache (Buffer) Size	None	None	None	16K or 32K	16K or 32K	16K or 32K	16K or 32K	32K	32K
Bus Architecture	No	No	No	No	No	No	No	No	No
Price per 1M Byte Of Main Memory	$5,000	$5,000	$5,000	$12,500	$12,500	$12,500	$12,500	$60,000[5]	$60,000[5]

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers were designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. Actual relative performance may vary with the application, peripherals and software.
2. Performance calculation includes vector utilization.
3. Million instructions per second; vendor claims.
4. Includes processor, power supply, console and all prerequisites (except for the 810, 830 and Dual 830, which do not include console).
5. For high-speed memory operating at a 64-Nsec access time 20 byte/sec. bandwidth.

CW Chart

HARDWARE ROUNDUP

Burroughs Corp.

System / Characteristics	A9-D	A9-F	B7900E	B7900F	B7900H	B7900K	A 15 Model F	A 15 Model I	A 15 Model L	A 15 Model N
Relative Performance[1]	90	110	95	370	474	1,185	725	1,378	1,897	2,837
Mips[2]	1.5	1.8	1.6	6.6	11.2	28	17.1	32.4	46.2	59.5
Memory Size in Bytes (Minimum-Maximum)	6M-12M	6M-12M	6M-8M	12M-48M	12M-48M	12M-96M	24M-96M	24M-192M	24M-192M	24M-192M
Purchase Price[3] (Memory Size)	$433,900 (6M)	$613,000 (6M)	$1,000,000 (6M)	$1,550,000 (12M)	$2,500,000 (24M)	$3,400,000 (36M)	$2,920,000 (24M)	$4,530,000 (24M)	$6,790,000 (36M)	$8,435,000 (36M)
Lease Price (Lease Term)	$17,372 (3 Year)	$24,562 (3 Year)	$39,900 (3 Year)	$127,842 (3 Year)	$170,729 (3 Year)	$170,729 (3 Year)	$124,100 (3 Year)	$193,305 (3 Year)	$289,329 (3 Year)	$359,580 (3 Year)
Machine Cycle Time (Nsec)	72.5	72.5	125	125	125	125	67	67	67	67
Channels[4] (Minimum-Maximum)	8-32	8-32	8-16	16	32-64	64-128	7x32	32-64	32-64	32-64
Cache (Buffer) Size	None	8K	144K	144K	144K	144K	Not available	Not available	Not available	Not available
Bus Architecture	No	No	Yes	No	No	Yes	No	No	No	No
Price per 1M Byte of Main Memory	$10,000	$10,000	$17,000	$17,000	$17,000	$17,000	$12,000	$12,000	$12,000	$12,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/168 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. For the processor, console, power supply and all prerequisites.
4. Burroughs processors use data link processors in place of conventional I/O channels. Does not include a communications subsystem.

CW Chart

Burroughs Corp.

System / Characteristics	B1990SP	B2925	B3955	V340	B5919-2	A3-D	A3-F	A3-K
Relative Performance[1]	31	31	46	71	104	35	35	58
Mips[2]	0.55	0.55	0.88	1.5	2.2	0.65	0.65	0.93
Memory Size in Bytes (Minimum-Maximum)	512K-1M	1M-5M	1M-5M	1.5M-8M	10M-20M	3M-6M	3M-24M	6M-48M
Purchase Price[3] (Memory Size)	$59,300 (512K)	$125,000 (1M)	$198,000 (2M)	$390,400 (10M)	$702,600 (10M)	$95,500 (3M)	$120,500 (3M)	$200,000 (6M)
Lease Price (Lease Term)	$3,017 (3 Year)	$4,328 (3 Year)	$6,737 (3 Year)	$17,328 (3 Year)	$30,411 (3 Year)	$4,686 (3 Year)	$5,897 (3 Year)	$9,744 (3 Year)
Machine Cycle Time (Nsec)	166	190	143	110	110	Not available	Not available	Not available
Channels[4] (Minimum-Maximum)	4-8	8-16	16-32	32-64	32-64	5-8	5-16	5-16
Cache (Buffer) Size	8K	None	None	None	None	None	None	None
Bus Architecture	No	No	No	No	No	No	No	No
Price per 1M Byte of Main Memory	$10,000	$10,000	$10,000	$10,000	$10,000	$6,000	$6,000	$6,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/168 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. For the processor, console, power supply and all prerequisites.
4. Burroughs processors use data link processors in place of conventional I/O channels. Does not include a communications subsystem.

CW Chart

International Computers Ltd.

System / Characteristics	Series 39 Level 30/1	Series 39 Level 30/2	2900 Series 2958	2900 Series 2966	2900 Series 2988	Series 39 Level 80/1	Series 39 Level 80/2
Relative Performance[1]	90	115	315	625	1,190	700	965
Mips[2]	1.3	2.4	1.7-3.1	2.7-4.9	4.9-8.6	11	19.8
Memory Size in Bytes (Minimum-Maximum)	4M-16M	4M-16M	8M-16M	8M-32M	8M-32M	16M-32M	32M-64M
Purchase Price[4] (Memory Size)	$194,000 (4M)	$434,000 (16M)	$359,000 (8M)	$639,000 (16M)	$878,000 (16M)	$1,563,000 (16M)	$3,331,000 (32M)
Lease Price[5] (Lease Term)	$6,594 (3 Year)	$14,756 (3 Year)	$12,206 (3 Year)	$24,275 (3 Year)	$33,310 (3 Year)	$44,692 (3 Year)	$95,183 (3 Year)
Machine Cycle Time (Nsec)	190	190	80	80	80	25	25
Channels[6] (Minimum-Maximum)	3-6	3-13	4-27	4-27	4-27	5-9	12-18
Cache (Buffer) Size[7]	52K	52K	17K	17K	17K	20K	20K
Bus Architecture	Yes	Yes	Yes	Yes	Yes	No	No
Price per 1M Byte of Main Memory	$7,920	$7,920	$9,550	$9,550	$9,550	$13,230	$13,230

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/168 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. Per processor. The 2900 series has a single- and dual-processor version for each model.
4. Includes processor, power supply, 0.6-1.7G-byte disk and all prerequisites.
5. Monthly hire, excluding maintenance.
6. Series 39 connects peripherals and terminals via local-area networks replacing traditional channels.
7. Two to three slave stores per processor depending on model.

CW Chart

THE BEST WAY TO KEEP YOUR COMMUNICATIONS FROM BEING TIED UP IS TO TIE THEM TOGETHER.

NETWORKING LINKS ALL YOUR VOICE AND DATA TERMINALS, WHEREVER THEY MAY BE. IT'S ONE OF MANY INTEGRATED FUNCTIONS OF AT&T SYSTEM 85 AND AT&T SYSTEM 75.

Everyone knows the old adage, "there's strength in numbers." That holds true only if the various elements, however numerous, are working together.

The Networking function of System 85 and System 75 from AT&T Information Systems unites all the elements of our business communications systems so everything works together. Whether you have offices spread throughout a building or throughout the country, they can all be linked productively into one network.

A NEW BUSINESS ASSET

A network should be looked at not simply as a communications tool, but as a business asset. Like any other asset your business holds, it too can be controlled and managed and made to work for you.

All our networks let you incorporate new applications, making your system more powerful than ever. And thanks to our integrated digital T-carrier interface, you can speed up and control the flow of not only voice, but data transmissions as well.

In a small area, like a campus, or even nationwide, look into our Distributed Communications System. With it, multiple systems serving up to 100,000 lines can function as one. It also offers extensive voice and data terminal transparency and attendant transparency, so attendants can control the entire system from one location.

Remote Groups let you extend System 85 capabilities to small locations via DS-1 facilities. Remote Modules serve larger locations, up to 2½ miles away, over fiber optics. Voice communications and data from host computers are transmitted with complete user transparency.

An Electronic Tandem Network can also be used to link locations anywhere in the country. Through a mix of analog, high-capacity digital, and public facilities, virtually any number of voice and data terminals can be connected.

CONTROL AND ECONOMY

Once you've linked your communications into one network, you'll have a host of powerful features working to increase productivity, reduce costs and give you more control over your communications. Automatic Route Selection, Automatic Alternate Routing, and Queuing choose the least expensive path for all network calls. And "Authorization Codes" grant calling privileges to appropriate employees.

With all your offices under the umbrella of one system, networking can help create another business asset—a single, consistent corporate identity for every branch of your organization.

INVESTMENT PROTECTION

System 85 and System 75 are designed according to the guidelines of Information Systems Architecture. This ensures that any upgrades or future generations of the system will be compatible with the current one. So your investment is protected.

There are over 350 ETN's and DCS's already in place. More than half of the *Fortune 500* companies have chosen private networks from AT&T Information Systems. Besides our features, function and investment protection, there's one more compelling reason why—our service.

Our systems are backed by the largest sales and service staff in the industry. Network support includes predesign, cutover coordination, post-cutover administration, and ongoing maintenance. Add to that a century of communications experience and leadership, and your decision is easy. Of all your alternatives, only one is the right choice—AT&T.

To find out more about the Networking capabilities of System 85 and System 75, call your AT&T Information Systems Account Executive or 1-800-247-1212.

AT&T
The right choice.

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The superminis

Perkin-Elmer Corp.

Characteristics \ System[1]	3203	3205	3210	3230	3250XP	3230XP	3230MPS	3260MPS
Relative Performance[2]	25	25	40	68	86	88	115-275	125-400
Mips[3]	0.39	0.39	0.61	0.98	1.33	1	1.7-4.5	1.9-7.2
Memory Size in Bytes (Minimum-Maximum)	512K-4M	512K-4M	512K-4M	1M-16M	2M-16M	1M-16M	2M-16M	2M-16M
Purchase Price[4] (Memory Size)	$22,100 (1M)	$30,000 (1M)	$58,900 (1M)	$98,700 (1M)	$193,000 (2M)	$85,000 (1M)	$125,000 (2M)	$222,100 (2M)
Lease Price (Lease Term)	None	None	None	None	None	None	None	None
Machine Cycle Time (Nsec)	Not available	Not available	250	250	Not available	Not available	Not available	Not available
Channels (Minimum-Maximum)	1	1	1-4	1-8	1-32	1-16	1-16	1-32
Cache (Buffer) Size	None	None	None	1K	8K	4K	4K-24K	8K
Bus Architecture	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte Of Main Memory	$4,900	$4,900	$7,000	$7,000	$7,000	$7,000	$7,000	$7,000

1. Several PE systems are available with multiple CPUs. The 3230MPS can support two to 16 CPUs and the 3280MPS can support two to 10 CPUs. Furthermore, the 3230XP and 3250XP uniprocessors are field upgradable to multiprocessor configurations.
2. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
3. Million instructions per second; vendor claims.
4. Includes processor, console, power supply and all prerequisites.

CW Chart

Hewlett-Packard Co.

Characteristics \ System	HP 3000 37	HP 3000 42	HP 3000 48	HP 3000 58	HP 3000 68
Relative Performance[1]	18	32	32	48	96
Mips[2]	0.25	0.5	0.5	0.75	1.5
Memory Size in Bytes (Minimum-Maximum)	512K-2M	1M-8M	2M-4M	2M-8M	4M-16M
Purchase Price[3] (Memory Size)	$21,950 (512K)	$57,735 (1M)	$98,255 (2M)	$125,255 (4M)	$226,740 (4M)
Lease Price (Lease Term)	Available	Available	Available	Available	Available
Machine Cycle Time (Nsec)	Not available	105	105	Not available	75
Channels (Minimum-Maximum)	1-3	2-4	2-5	2-5	3-15
Cache (Buffer) Size	None	None	None	32K	8K
Bus Architecture	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$6,000	$9,000	$9,000	$7,500[4]	$8,750[5]

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; vendor claims.
3. Includes processor, console, power supply and all prerequisites.
4. Available in 2M-byte increments costing $15,000.
5. Available in 4M-byte increments costing $33,000.

CW Chart

Wang Laboratories, Inc.

Characteristics \ System	VS65	VS85	VS100	VS300
Relative Performance[1]	40	57	67	201
Mips[2]	0.6	1.3	1.3	3.3
Memory Size in Bytes (Minimum-Maximum)	1M-4M	2M-8M	2M-16M	4M-16M
Purchase Price[3] (Memory Size)	$19,950 (1M)	$77,700 (2M)	$99,750 (2M)	$170,000 (4M)
Lease Price[4] (Lease Term)	Price not available	Price not available	Price not available	Price not available
Machine Cycle Time (Nsec)	200	160	160	120
Channels[5] (Minimum-Maximum)	6	6	16	16
Cache (Buffer) Size	16K	None	32K	32K
Bus Architecture	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$6,300	$8,000	$8,000	$10,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; vendor claims.
3. Includes processor, console, power supply and all prerequisites.
4. Wang offers a five-year rental plan instead of a conventional lease.
5. Capacity for I/O processor or device controllers.

CW Chart

Prime Computer, Inc.

Characteristics \ System	Series 50 2250	Series 50 2550	Series 50 9650	Series 50 9750	Series 50 9955
Relative Performance[1]	25	42	52	101	229
Mips[2]	0.47	0.73	0.9	1.75	4
Memory Size in Bytes (Minimum-Maximum)	512K-4M	2M-4M	2M-8M	4M-12M	4M-16M
Purchase Price[3] (Memory Size)	$29,900 (512K)	$98,500 (2M)	$135,000 (2M)	$240,000 (4M)	$360,000 (4M)
Lease Price (Lease Term)	$996 (5 Year)	$2,292 (5 Year)	$3,141 (5 Year)	$5,584 (5 Year)	$8,377 (5 Year)
Machine Cycle Time (Nsec)	160	160	160	100	80
Channels[4] (Minimum-Maximum)	1-4	1-8	1-10	1-10	1-14
Cache (Buffer) Size	2K	16K	16K	16K	64K
Bus Architecture	No	No	No	No	No
Price per 1M Byte of Main Memory	$7,900	$7,900	$7,900	$7,900	$7,900

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers do not constitute a buyer's guide.
2. Million instructions per second; vendor claims.
3. Purchase price includes central processor, diagnostic processor, cabinet, chassis, Prime's Primos operating system and minimum disk/tape configuration.
4. Available I/O chassis slots.
5. Purchase price for add-on memory.

CW Chart

Motorola/Four Phase Systems, Inc.

Characteristics \ System	Series 2000 Model 260	Series 2000 Model 290
Relative Performance[1]	36	72
Mips[2]	0.5	1
Memory Size in Bytes (Minimum-Maximum)	512K-1M	1M-2M
Purchase Price (Memory Size)	$10,930 (512K)	$14,095 (1M)
Lease Price (Lease Term)	$670 (2 Year)	$525 (2 Year)
Machine Cycle Time (Nsec)	825	450
Channels (Minimum-Maximum)	8-20	8-20
Cache (Buffer) Size	None	None
Bus Architecture	Yes	Yes
Price per 1M Byte of Main Memory	$3,625	$3,625

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. Actual performance can vary with the application, peripherals and software.
2. Million instructions per second; vendor claims.

CW Chart

HARDWARE ROUNDUP

Charles River Data Systems, Inc.

Characteristics \ System	Universe 68/05	Universe 68/35	Universe 68/137	Universe 2402	Universe 2403	Universe 32/35	Universe 32/115
Relative Performance[1]	77	77	77	77	77	154	154
Mips[2]	1.25	1.25	1.25	1.25	1.25	2.7	2.7
Memory Size in Bytes (Minimum-Maximum)	512K-3M	1M-12M	512K-5M	512K-10M	1M-10M	1M-12M	1M-12M
Purchase Price[3] (Memory Size)	$13,500 (512K)	$16,700 (1M)	$28,700 (1M)	$9,999 (512K)	$17,000 (1M)	$23,000 (1M)	$24,900 (4M)
Lease Price (Lease Term)	None	None	None	None	None	None	None
Machine Cycle Time (Nsec)	320	320	320	320	320	Not available	Not available
Chassis (Minimum-Maximum)	1-3	1-64	1-5	1-64	64	4-64	2-64
Cache (Buffer) Size	4K	4K	4K	4K	4K	8K	8K
Bus Architecture	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200	$1,200

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; vendor estimates.
3. Includes processor, operating system, power supply and all prerequisites.

CW Chart

Formation, Inc.

Characteristics \ System	F4000 Model 100	F4000 Model 200	F4000[1] Model 200AP	F4000[2] Model 300	F4000[2] Model 300AP
Relative Performance[3]	12	16	20	18	22
Mips[4]	0.20	0.32	0.36	0.24	0.38
Memory Size in Bytes (Minimum-Maximum)	256K-8M	256K-8M	256K-8M	256K-8M	256K-8M
Purchase Price[5] (Memory Size)	$57,000 (1M)	$70,000 (1M)	$82,500 (1M)	$97,000 (2M)	$123,400 (2M)
Lease Price (Lease Term)	None	None	None	None	None
Machine Cycle Time (Nsec)	800	800	800	800	800
Chassis (Minimum-Maximum)	0-4	0-4	0-4	0-4	0-4
Cache (Buffer) Size	None	None	None	None	None
Bus Architecture	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$10,000	$10,000	$10,000	$10,100	$10,100

1. The firm's Model 200 supports processor upgrades only under IBM's VM/370 operating system.
2. Model 300 processors feature fail-soft capabilities, the vendor said.
3. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
4. Million instructions per second; vendor claims.
5. For the processor and main memory only.

CW Chart

AT&T

Characteristics \ System	3B20S	3B20A
Relative Performance[1]	65	97
Mips[2]	1	1.8
Memory Size in Bytes (Minimum-Maximum)	2M-16M	2M-16M
Purchase Price[3] (Memory Size)	$190,000 (2M)	$245,000 (2M)
Lease Price (Lease Term)	None	None
Machine Cycle Time (Nsec)	400	400
Chassis[4] (Minimum-Maximum)	4	4
Cache (Buffer) Size	8K	16K
Bus Architecture	Yes	Yes
Price per 1M Byte of Main Memory[5]	$3,750	$3,750

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. For a basic configuration.
4. The 3B20 series processors can accommodate four disk controllers, which can support a total of 32 disk drives, and four I/O processors, which can support up to 64 peripheral controllers.
5. Available in 2M-byte increments costing $7,500.

CW Chart

Microdata Corp. (Division of McDonnell Douglas Corp.)

Characteristics \ System	M9000 99950
Relative Performance[1]	20
Mips[2]	0.54
Memory Size in Bytes (Minimum-Maximum)	512K-8M
Purchase Price[3] (Memory Size)	$99,950 (512K)
Lease Price (Lease Term)	None
Machine Cycle Time (Nsec)	150
Chassis (Minimum-Maximum)	8-128
Cache (Buffer) Size	None
Bus Architecture	Yes
Price per 1M Byte of Main Memory	$14,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. Includes a 100/50 in./sec. streaming tape drive, a 130M-byte Winchester disk subsystem and eight I/O ports.

CW Chart

Digital Equipment Corp.

Characteristics \ System	VAX-11/725	VAX-11/730	VAX-11/750	VAX-11/780	VAX-11/782	VAX-11/785	VAX 8600
Relative Performance[1]	20	20	40	67	100	100	285
Mips[2]	0.36	0.36	0.72	1.06	1.9	1.7	4.4
Memory Size in Bytes (Minimum-Maximum)	512K-3M	1M-3M	1M-8M	1M-64M	4M-8M	2M-64M	4M-32M
Purchase Price[3] (Memory Size)	$24,900[4] (1M)	$21,500 (1M)	$51,000 (1M)	$145,000 (2M)	$320,000 (4M)	$195,000 (2M)	$350,000 (4M)
Lease Price (Lease Term)	None	None	None	None	None	None	None
Machine Cycle Time (Nsec)	810	810	400	290	290	166	80
Chassis (Minimum-Maximum)	1	1	1-4	1-8	1-8	1-8	1-11
Cache (Buffer) Size	None	None	4K	8K	16K	32K	16K
Bus Architecture	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$4,900	$4,900	$4,900	$4,500[5]	$4,500	$4,500[5]	$4,500

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. For a basic configuration consisting of 1M byte of main memory, power supply, cabinetry and a VMS operating system license.
4. Includes 52M bytes of disk storage.
5. Memory upgrades are available in a minimum 2M-byte configuration for $9,000.

CW Chart

The superminis

Harris Corp.

Characteristics \ System	Harris 80	Harris 600	Harris 700	Harris 800	Harris 1000	Harris 1200	HCX-7
Relative Performance[1]	45	45	53	53-74	114	231	340
Mips[2]	0.76	0.76	0.89	1.1-1.6	4.9	5	7.5
Memory Size in Bytes (Minimum-Maximum)	768K-12M	768K-12M	384K-12M	768K-12M	1.5M-12M	1.5M-12M	2M-8M
Purchase Price[3] (Memory Size)	$86,900[4] (768K)	$38,900 (768K)	$49,900 (384K)	$139,000 (768K)	$250,000 (1.5M)	$294,000 (1.5M)	$275,000 (2M)
Lease Price (Lease Term)	None	None	None	None	None	None	None
Machine Cycle Time (Nsec)	300	300	300	180	75	75	100
Channels (Minimum-Maximum)	8	8	24	31	31	31	28
Cache (Buffer) Size	6K[5]	6K[5]	6K[5]	6K[6]	6K	288K	44K
Bus Architecture	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte of Main Memory[7]	$10,000	$10,000	$10,000	$10,000	$10,000	$8,000	$7,000[8]

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide.
2. Million instructions per second; CW estimates.
3. Includes processor, console, power supply and all prerequisites.
4. Includes an 80M-byte disk drive, 28 in./sec. cartridge tape drive and the firm's VOS operating system.
5. Optional.
6. Optional on some models.
7. For a 6M-byte increment.
8. Based on a 4M-byte memory enhancement costing $28,000.

Modular Computer Systems, Inc.

Characteristics \ System	Classic[1] 32/85	Classic 32/85A
Relative Performance[2]	1.25	1.25
Mips[3]	2.5	2.5
Memory Size in Bytes (Minimum-Maximum)	2M-8M[4]	2M-8M[4]
Purchase Price (Memory Size)	$148,500 (2M)	$166,500 (8M)
Lease Price (Lease Term)	None	None
Machine Cycle Time (Nsec)	110	110
Channels (Minimum-Maximum)	64	64
Cache (Buffer) Size	64K	64K
Bus Architecture	Yes	Yes
Price per 1M Byte of Main Memory[5]	$6,000	$6,000

1. Also available in two redundant, fault-tolerant models.
2. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/156 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
3. Million instructions per second; vendor claims.
4. Available in 2M-byte configurations costing $12,000.

Data General Corp.

Characteristics \ System	MV/4000DC	MV/4000	MV/8000 II	MV/10000
Relative Performance[1]	30	30	71	138
Mips[2]	0.6	0.6	1.2	2.5
Memory Size in Bytes (Minimum-Maximum)	1M-2M	1M-4M	1M-8M	1M-16M
Purchase Price[3] (Memory Size)	$38,200 (2M)	$63,400 (1M)	$125,300 (1M)	$211,070 (2M)
Lease Price (Lease Term)	None	None	None	None
Machine Cycle Time (Nsec)	200	200	220	140
Channels (Minimum-Maximum)	2	2	2	2
Cache (Buffer) Size	None	None	16K	16K
Bus Architecture	Yes	Yes	Yes	Yes
Price per 1M-Byte of Main Memory	$4,900	$4,900	$4,900	$4,900

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. For the processor with disk and tape units, system software and system console.

Gould, Inc. Computer Systems Division

Characteristics \ System[1]	Concept 32/27	Concept 32/67	Concept 32/97
Relative Performance[2]	70	140	410
Mips[3]	1	3	10.1
Memory Size in Bytes (Minimum-Maximum)	1M-16M	1M-16M	1M-16M
Purchase Price[4] (Memory Size)	$55,000 (2M)	$99,000 (1M)	$245,000 (4M)
Lease Price (Lease Term)	None	None	None
Machine Cycle Time (Nsec)	150	150	75
Channels[5] (Minimum-Maximum)	0-7	0-13	0-17
Cache (Buffer) Size[6]	None	32K	32K-64K
Bus Architecture	Yes	Yes	Yes
Price per 1M Byte of Main Memory	$9,500	$9,500	$9,500

1. The Concept line was designed to operate with Gould's MPX operating system. The same basic systems are available with Gould's UTX version of AT&T's Unix operating system. Those systems are called the PN6000 and PN9000 and support virtual memory.
2. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
3. Million instructions per second; CW estimates.
4. For the processor, 2M bytes of main memory, 80M bytes of disk storage, a tape unit and systems software.
5. Available CPU slots to which I/O devices can be attached.
6. The 32/67 and 32/97 are available in dual-processor configurations. On those systems, cache memory is doubled.

Apollo Computer, Inc.

Characteristics \ System	DN 300, DN 320	DN 330	DN 550	DN 560	DN 460, DN 660
Relative Performance[1]	30	70	30	70	70
Mips[2]	0.4	1	0.4	1	1.2
Memory Size in Bytes (Minimum-Maximum)	1M-2M	2M-8M	1.5M-2M	2M-8M	1M-8M[3]
Purchase Price[4] (Memory Size)	$9,900 (1M)	$15,900 (2M)	$28,500 (1M)	$35,500 (2M)	$39,500 (4M)
Lease Price (Lease Term)	None	None	None	None	None
Machine Cycle Time (Nsec)	Not available	Not available	Not available	Not available	Not available
Channels (Minimum-Maximum)	2	2	2	2	3
Cache (Buffer) Size	None	64	None	64	20K[5]
Bus Architecture	Yes	Yes	Yes	Yes	Yes
Price per 1M Byte Of Main Memory	$3,000	$3,000	$3,000	$3,000	$3,000

1. CW estimates based on vendor-supplied information. Relative performance ratings are based on an IBM 370/158 Model 3 equaling 45. These numbers are designed to put the processor into perspective with other systems; they do not constitute a buyer's guide. All systems are not alike; they use different operating systems, instruction sets and architectures and, therefore, cannot be directly compared. In addition, actual relative performance may vary with the application, peripherals and software.
2. Million instructions per second; CW estimates.
3. For the DN 460. The DN 660 is available with 1M-8M bytes of main memory.
4. Includes processor, power supply, console and the vendor's Domain local-area network.
5. Cache memory includes 4K bytes for instructions and 16K bytes for data.

IN DEPTH

The science and art of debugging

By James H. Bradley



PHOTO BY O'CONNELL/VOUCURI

Debugging programs is the most scientific and systematic part of software work, provided the code is reasonably structured and economically documented. Because testing and debugging soak up about 25% of software development and maintenance costs — nearer 50% when maintenance costs are suballocated — systematic debugging is important.

Unfortunately, even the best books on testing regard debugging as a black art. In *Software System Testing and Quality Assurance* (Van Nostrand Reinhold, 1984), Boris Beizer suggests that "... debugging, so far, has not been amenable to theoretical treatment."

He adds, "Testing can and should be designed and scheduled beforehand. The procedures for, and duration of, debugging cannot be so constrained."

Beizer rightly says, "Debugging demands intuitive leaps, conjectures [the polite term is working hypotheses], experimentation, intelligence and freedom." Yet he contrasts debugging with testing, describing the latter as "predictable, dull, constrained, rigid and inhuman."

In my view, both testing and debugging are all these things. Debugging is a straightforward application of the scientific method that has been developed over 2,500 years. The basis of debugging is to locate a problem's source by binary partitioning, through working hypotheses that predict new values to be examined.

Take a simple, nonsoftware example: A lamp in my house does not work. If nothing in the house works, the cause must be in the main circuit breaker or outside; I look around to see whether the neighborhood is blacked out. If some things work, I plug the suspect lamp into a working socket and a working appliance into the suspect circuit. So goes the alternation of hypothesis and test.

Note that much of the testing uses substitution techniques; software designers call these techniques drivers and stubs. Software designed to be testable and debuggable has a judicious number of built-in drivers, stubs, trace features, counters and means for listing internal variables — all controlled by flags listed in the maintenance and support manuals. Often one of the stubs is the previous version of the code.

Possibly the bug may act up intermittently, or multiple bugs may be present. In this case, confirmatory evidence of these incidences is sought.

What is a bug, anyhow? Most alleged bugs are enhancements, errors and gaps in manuals or incorrect documentation. Errors in test plans are about as common as errors in code. Unsuitable numerical methods are often at fault.

I define a bug as a discrepancy between actual and expected system behavior, caused by a few local errors in a few lines of code or a few entries in a table. Redesign, research and development are not debugging. There must be documentation of the intended system behavior separate from its actual performance; otherwise, the system is lousy, not buggy. Ambiguous specifications and test plans are common; in counting people over age 60, for example, does everybody agree on how to count somebody who is between 60 and 61?

It is ironic that structured, rigorous specifications are so popular just when the market is booming in products that require less rigid specifications. Software for general sale, such as word processing tools, spreadsheets and data bases, is flexible and has many trade-offs, with

minor effects on its marketability. Specifications are often given in general terms for responses to user and data errors, error checking of inputs, demands for confirmation of unusual inputs and backup code to handle supposedly impossible situations. Users shopping around for a commercial item or evaluating an existing product for a new application necessarily have both set and flexible requirements.

However, debugging requires documentation of the intended functions of code, even if somebody has made some variable, arbitrary choices. Systems have to be deloused before they can be debugged. Even in serious scientific computing, which often discards code after a single use and where rounding or discretization error and other perpetual problems cause incompletely predictable behavior, algorithms must be documented before they can be debugged.

Managers should note that bugs come in swarms, not singly. Check around: Much depends upon the programmer's mental state, which is profoundly affected by working conditions, noise, interruptions and excessive meetings. Where one bug is found, a whole nest is probably nearby.

Partitioning

Some bugs are hard to find because they can be intermittent (dependent upon concurrent uses of the system); insufficiently local, especially in certain types of artificial intelligence, multipass algorithms and feedback and feedforward loops; or dependent upon particular data values or upon the history of the inputs.

They can also be the result of unintended interactions and overwriting of values such as conflicting or invalid access to data; or even caused by hardware, compilers, loaders, operating systems or electrical interference. Even in these harder cases, the best method is usually partitioning through tests based on working hypotheses.

In practice, a batch run to dump a trace of execution and some intermediate values should normally record enough detail to partition the problem into four to eight pieces. In the interactive use of simple special stub code, binary partitioning is common because the mode of execution is set interactively via a few flags.

Aside from computers and accompanying peripherals, the following resources are needed in debugging:

- A test plan, discrepancy report or complaint.
- A test report or other supporting data.
- Data flow diagrams, state-transition diagrams, augmented transition networks, event analyses, detailed specifications and other structured documentation of intended system behavior. The test plan is too local a specification.
- Maintenance and support manuals showing all the nonpublic flags, trace, counters, dumps and internal interfaces as well as the basic structure chart.
- New and old listings of code and tables, with engineering change orders.
- Manuals for job control language, operating system, languages and other metafacilities.
- Suitable working space, good conditions and freedom from disturbances and interruptions.

Flow charts and program design language, if any, should be converted to the canonical form of sequence, loop and decision construct, even if the actual code is unstructured. That is how, in a radar system, I found an 18-year-old bug that had always been blamed on the weather. R. C. Tausworthe gives specific methods and examples of conversion in part one of his book, *Standardized Development of Computer Software* (California Institute of Technology, 1976). The delousing of unstructured and undocumented code starts with the preparation, in canonical form, of flow charts, then data flow diagrams and structure charts and then other structured documentation.

> ***Redesign, research and development are not debugging.***

Debugging is not a universal planned-response system; one does not automatically rerun the job with trace. Instead, one or more hypotheses are formed, based on data flow diagrams, event analyses or flow charts, to define what trace to print. Other steps include the following:

- Try to collect related values that may already be available. Trace the tree, or network, of causality both forward and backward. Predict indirect — backward then forward — consequences that can be examined — in the analogy of the lamp that doesn't work, check other appliances on other circuits.

Use an appropriately partitioned data flow diagram and event analysis as a tree of causality. Event analyses are used much like an expert system: Forward event analyses show what should respond in what way to each external, temporal or internal event; backward event analyses trace the circumstances and causes of each outgoing data or control flow.

- Trace the possible common origins of several known problems. Discard effects that are probably consequences of known errors or treat them as supporting or refuting evidence. Correlate bugs that sometimes appear together, seeking the possibility of joint causes.
- Try bypasses, rearranging the input or providing information that was previously calculated. For example, some software treats trailing

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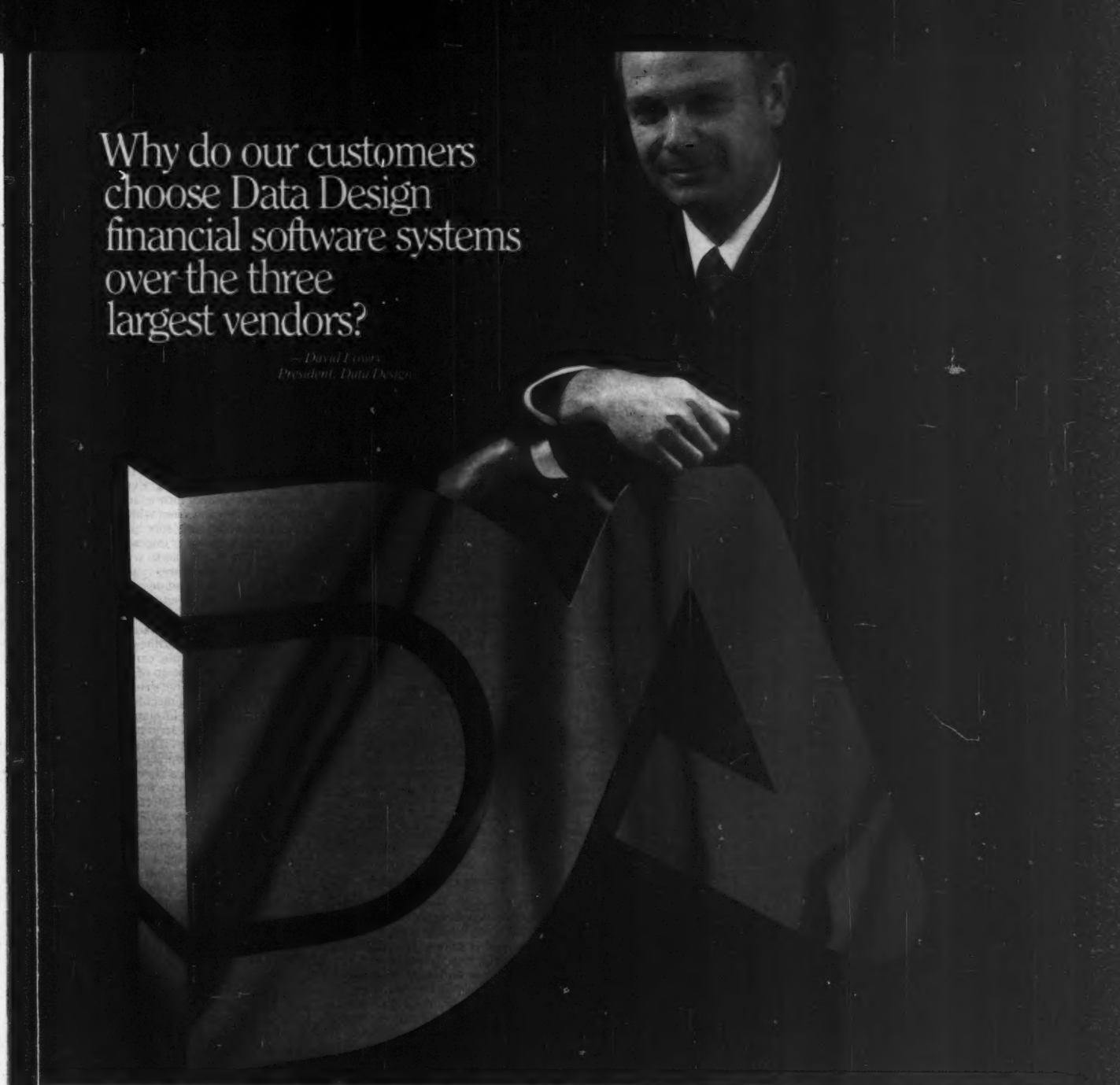
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blanks as zeros instead of an end-of-field; one can give a scaling value for a graph instead of calculating it from the data.

■ Look for what was recently modified and recompiled. Possibly use the previous version of the code as the backup or one of the backup codes, depending upon the scope of the modifications.

Retesting a corrected bug can be rationally scoped from analyses of causality — the doctrine of 100% retesting after every change is an economically ruinous fantasy. Remote ripple effects are rare in structured, documented software. Check for overloads on communications links, data stores that may overflow and other critical constraints approaching saturation.

■ Test around the boundary values if they are known: for example, those values that cause changes in logical decisions. Where boundary values are known — even if they are incorrectly implemented — one can often avoid stumbling into changes of logical state. Minor adaptations are needed for values that are the cumulation of inputs or other statistics; they cause the operation to be history-dependent.

■ Force and read the values at interfaces — for instance, at each primary input. Define the range of values (possibly close to infinite) that produce erroneous results. A bug can be in a consistency check or auditing control rather than in the main computation, and in arithmetic of finite precision, it may be only the comparison that is wrong.

As part of testing, look for the numerical outputs normally to be smooth, continuous functions of the values of the inputs. This can be of some help in debugging. Examine the repeatability of bugs to look for particular data items, values and unintended interactions via languages, linkers and operating systems.

Real-time systems interacting with external hardware cannot normally rerun identical jobs; airline flights and missile launches cannot be scheduled for the convenience of maintenance programmers. Real factories and facilities may be unusable for testing because of safety and economy. (The maintenance programmer may be debugging the response of a safety system to malfunctions that must not be recreated.)

In such cases, and in many data processing applications, it is possible to spawn or create a separate task with dummy output files and recorded input files. Good supervisory control and data acquisition systems have one or more simulated modes of operation. For example, airlines and nuclear power facilities have large logging systems with files that are used primarily for postmortem problem analyses, including software bugs.

The art of systematic debugging

The process of systematic software debugging involves the following stages:

Predict downstream consequences in order to ignore them or treat them as verification or as supporting evidence.

Hypothesize upstream causes that can be examined, either from existing files and records or via special runs.

Examine other variables in the vicinity for errors, which may possibly indicate joint causes or the exclusion thereof.

Examine other numerical values or cases for errors, which may define relevant boundary values, breakpoints or destruction of common data.

Run the backup code(s).

Examine the repeatability of bugs for possible unintended interactions with other programs.

Run the code with trace (enter leave messages), dumps of selected internal values and interfaces and passage counters.

Most importantly, for each hypothetical upstream cause, **predict variables downstream from the supposed cause but upstream or parallel to effects already known** that can be scrutinized.

Testing and debugging

Existing textbooks talk only of deterministic testing, not of testing with any unpredictable or possibly predefined random or uncontrollable elements. Statistics go largely unmentioned. The theory and practice of the analysis of variance is absent. Consistency, not correctness, should be tested often; there should be at least as many people over 59 as over 60. Results predictions are often qualitative, semiquantitative or Boolean. Often the prediction is for no externally visible change in the state of the system (but, of course, normally the input is not totally ignored and is never scrutinized).

The textbooks also talk about testing by or on behalf of the organization that built or commissioned the software. Testing of commercial or existing products for acceptability in a new application has a lower degree of results predictability. Debugging such systems is more difficult, but the same methods work.

Testing requires special access to interfaces and theoretically unreachable backup code. Debugging should not require an additional access facility but may use special trace. Testing and debugging can often be partially combined, in that testing may generate output needed only if a bug is found. Backup code should be designed so that its automatic — unexpected — invocation preserves information about circumstances, states and relevant values, possibly including the invocation path. Debugging may require predictions of values that are not spelled out in the test plan and documentation.

Trace can be hierarchial (several levels), selective (several subtrees) or tabular (a list of modules, entrances and exits to be recorded). Good systems provide flags for selective execution of modules and a data assignment and retrieval facility running in apparent concurrency with the main job. In real-time, an apparently concurrent facility, such as an externally interactive system, is vital.

Debuggability design

Design for debuggability is related to, but not identical to, design for testability. In testing, a sequence of inputs relates more to internal states and outputs; internal states and memories may be viewed as outputs, while in debugging they *must* be viewed as outputs. Testing predicts certain consistency relations; debugging finds out why they are not obeyed. Testing may be concerned with coverage, but debugging is concerned only with coverage along the paths of intended or unintended causality.

A poor architecture is one in which data structures are identified by function. Each module should normally write into one (rarely two or three) data structure, with one module writing each structure.

This process may seem unnatural in systems with queues and stacks, and the structured analysis may or may not show the guardian access machines (which prevent invalid or conflicting access to stored data), but it is normally so. It may be especially unnatural in large data base systems, where one user may cause many files to be updated, but even there it is normally true at the module level.

Errors due to misuse of names or to overwriting are difficult to catch. One can, however, turn off the code that may be overwriting. Examine the data structures into which each module writes and from which it reads; good preprocessors have a list of the data structures into which each module is allowed to write.

A few data structures must be writable by many modules, chiefly via indivisible TEST and SET instructions for interlocks. Access may have to be masked via guardian access machines, as in airline data bases. In some cases one can use cyclic pickup, invocation of a transfer routine mapping between data stores or a triggering mechanism.

An understanding of mappings is facilitated if all data structures are shown as stored, even if little or no inherent nonconcurrency exists in the system; every data flow shown in the documentation becomes some variety of store in the electronics.

Debugging, a simple application of the oldest rules of the scientific method to software, includes the adequate definition of the software's intended operation as distinct from the actual implementation. In the future, software designed for testability and debuggability will have a major impact in the software market.

About the author

James Bradley is an independent consultant and teacher based in Atlantic Highlands, N.J. Bradley specializes in structured and numerical methods and support software applied to simulation. He is associate editor of the periodical Simulation.

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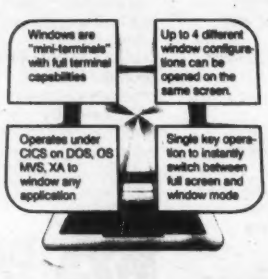
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IN DEPTH

The microcomputer and decision support

By Howard Morgan

The use of decision support system (DSS) tools has grown tremendously since the late 1970s, when microcomputing was introduced into the managerial world. DSS tools are more sophisticated and easier to use, and many managers now take advantage of them to perform complex analyses of portions of their business — an unheard-of event five years ago.

Yet with this growth have come problems: getting proper data for models; validating these models; integrating their use with standard corporate systems; and dealing with the issues of training, privacy and competition.

DSS are meant to be systems that support humans in making better decisions, not just systems that merely automate the decision-making function.



ILLUSTRATION BY KEVIN CONKLIN

This distinction gives a better perspective on how the micro can help.

The four basic elements of any DSS are decision, model, data and user interface. A wide variety of DSS, ranging from spreadsheets to artificial intelligence models of human behavior, can be constructed with these four elements.

Now, packages consistently are being announced with more specialized models already built in. A rapidly growing base of micro users with neither the interest nor the training for programming their own systems reinforces this trend toward vertical market DSS.

Spreadsheets

The most widely used modeling tool is the spreadsheet. The original one, Visicalc, was developed by Software Arts, Inc. under severe memory and processing capacity constraints. Nevertheless, with it, even a 48K-byte Apple Computer, Inc. Apple II+ could be used to model balance sheets, income statements and cash flows in hours rather than days or weeks. Spreadsheets are well understood by accountants and financial managers, many of whom found a secret wish fulfilled when they acquired the ability to build a spreadsheet that instantly showed the results of any change.

The "what-if" facility of a spreadsheet or any DSS helps support the decision-making process. For example, a food service company is required to prepare proposals. These proposals specify costs of feeding individuals in health care facilities at satisfactory levels of nutrition.

> ***Spreadsheets are well understood by accountants and financial managers, many of whom found a secret wish fulfilled when they acquired the ability to build a spreadsheet that instantly showed the results of any change.***

Prior to Visicalc, each proposal required two people's efforts for three days, during which time they tried two alternative menus and bid the lower cost menus. As the work load grew, it became difficult to train additional people for the bidding task.

When the company's president was introduced to Visicalc in 1980, his reaction was, "I can use that right now!" Within a week, employees were preparing bids in less than three hours and analyzing 12 different menus in the process. In addition, this ability to analyze differing selections of foods generated more winning bids.

Which spreadsheet program is best? For a specific application, any of the major spreadsheets — Lotus Development Corp.'s 1-2-3, Microsoft Corp.'s Multiplan or Sorcim Corp.'s Supercalc 3 — may have an advantage over one another, but the overall functionality is basically the same.

Most users prefer to stay with whatever spreadsheet they first learned. More experienced personal computer users had been staying with advanced versions of Visicalc; however, the package was recently taken off the market. Most newer IBM Personal Computer users have chosen 1-2-3. Because Microsoft has priced Multiplan very low if bundled with a system, that product has high penetration on non-IBM systems and adequate sales in the IBM market.

When introduced, Lotus' 1-2-3 took advantage of the memory available in the large, 16-bit micros and was written to be very efficient in running speed — an advantage it still retains. The integrated graphics give the user a choice on the output side — graphics often being a more efficient way to present decision variables. The 2,048 rows available in 1-2-3 allow large models and small data bases to be created and maintained without the need for learning any other package.

Multiplan, written in the C language, can be ported to a large variety of systems. A Multiplan user can easily do multipage spreadsheets, using the package's third dimension for consolidations. In addition, the use of templates has been encouraged.

Supercalc 3.2, with its earlier versions' restrictions on number of rows removed, is now a worthy competitor for 1-2-3's market.

Financial planning systems

As you reach the limits on the functions available in the simple spreadsheets, financial planning systems become more attractive. These systems lack the totally interactive model building and execution of spreadsheets, but they can work with larger amounts of data.

Systems such as Micro-DSS/Finance from Addison-Wesley Publishing Co., Finar from Finar Research Systems Ltd. or Microplan from Chang Laboratories, Inc. perform present value, cash flow, depreciation and regression analyses on models with very large amounts of data. For example, Desk Top Financial Solutions, Inc.'s DTFPS can handle 500-by-100,000-cell worksheets.

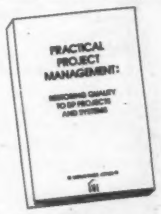
Financial planning systems are particularly useful if an organization has one central group build a model (for example, for budgeting), and many different users then work with that model on their own departmental data.

A more general interactive equation handler is TK!Solver, which is owned by Lotus but was developed by the same Software Arts team that developed the original Visicalc concept. With TK!Solver, the user inputs equations in algebraic format, along with definitions for the variables in

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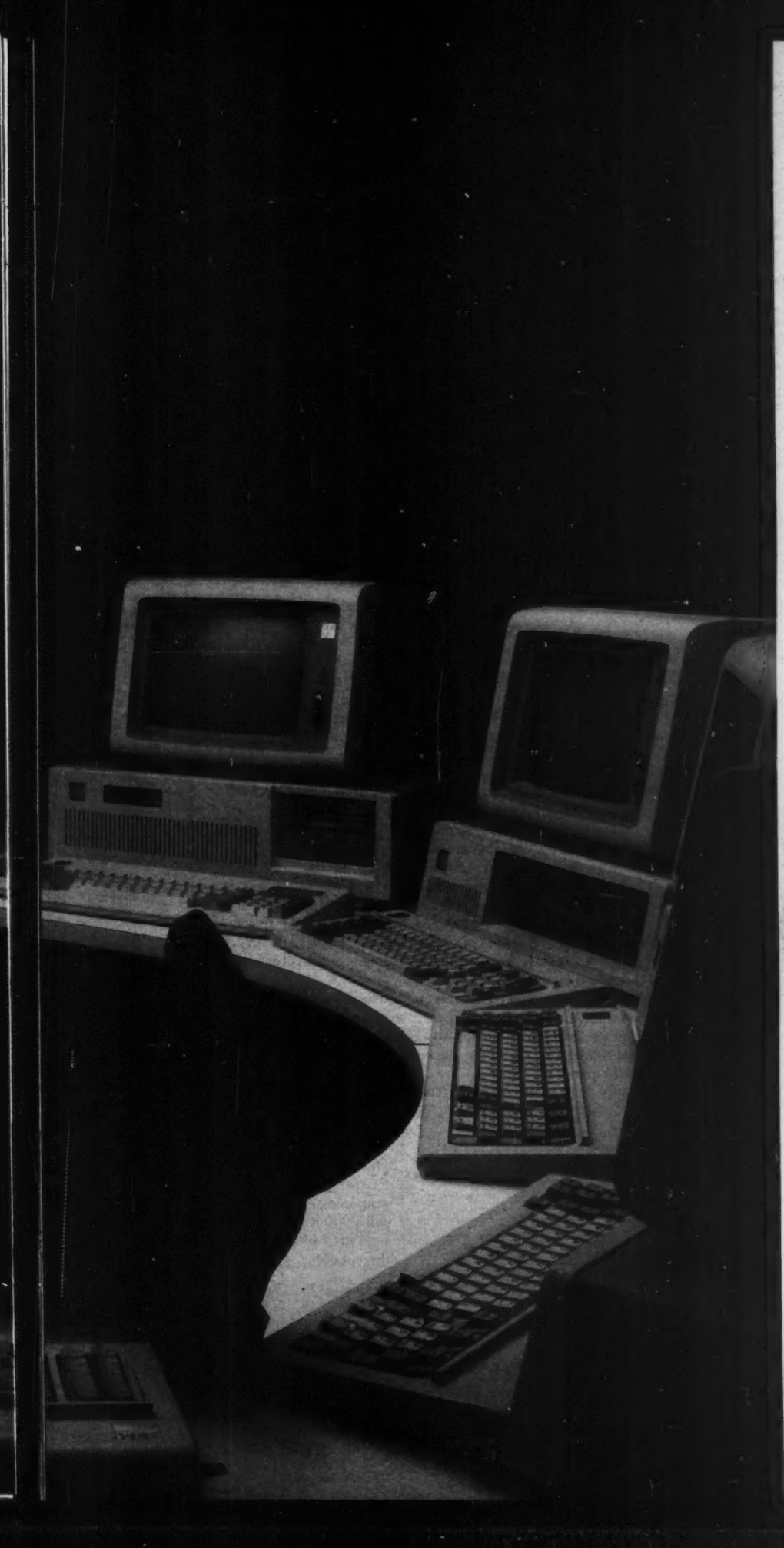
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the equations. You then specify values for variables on either right or left sides and let the system solve (or back-solve) the system of equations to fill in any undetermined values.

The same "what-if" concept that financial types have become used to with Visicalc is now available to civil engineers, circuit designers, econometric forecasters and others who can formulate equations to describe their decision situation. Although not nearly so popular as Visicalc, these options are being used more often, especially in the engineering field.

Traditional decision support tools have often grown out of the operations research methodologies. Linear and integer programming, queueing models, multiple linear regression and other operations research techniques are now available on micros. For example, the DSM package from DSS, Inc. integrates a number of such systems.

The user interfaces to build such models still require more work. It takes a knowledgeable user or consultant to understand how to define and structure a model. When such models are set up, however, they can yield impressive results.

Artificial intelligence

Artificial intelligence has long been a goal of many researchers and workers in the decision support field. Rather than modeling the system, AI programs model the brain of the most intelligent decision maker — thereby building on experience.

Most successful AI programs require massive computing environments. As a result, many observers believe it will be some time before micros can do much in the AI domain.

Nevertheless, several vendors have borrowed from AI in some way. One, Human Edge Software Corp. has a set of packages that are meant to aid in negotiating, sales and personnel management strategies and tactics. The set's packages require users to answer a large number of questions, first about themselves and then about the specific situation.

For example, a sales representative might characterize a customer as a bargain hunter who is concerned about features and who must make a decision by next Thursday. The system, after reviewing the salesperson's own tactics, may suggest pushing features and asking a higher price, then cutting the price at the end to give the customer the feeling of getting a bargain. This advice, which may seem simplistic, can help clarify thinking about how to approach others in similar situations.

Another support tool is a package called Lightyear, from Lightyear, Inc. It is designed to help managers work with both quantitative and qualitative information in analyzing a decision.

Like a spreadsheet package, Lightyear performs bookkeeping functions and data display; unlike spreadsheets, however, it has a lot of built-in knowledge about decision analysis. Users list the alternatives available (for example, sites in plant site selection), define criteria and their importance (cost, quality of labor, quality of life and so on) and evaluate criteria using numbers, words or positioning marks on a line.

Lightyear also permits the user to add rules (similar to expert system rules) to help eliminate alternatives. Users can then see summaries, compare alternatives and observe the effects of specific rules or models on the evaluation process.

Whether end users will take the time to input all the data in order to benefit from Lightyear's power remains to be seen, but it is clearly an interesting new concept in decision support.

Expert Ease, developed from research done at the University of Edinburgh, tries to deduce the classification rules of experts by examining attributes of specific cases of a decision. A Visicalc-type interface is used to present cases as rows of a large spreadsheet, with attributes of the decisions as the columns.

For example, the decision may be to grant or deny credit to a customer. Attributes might include salary, years in current residence, amount of purchase and so on. Given a set of cases, the system will come up with a decision rule that will yield the same results or will point out inconsistencies in the data, noting the need for additional attributes.

Graphics

A broad range of packages for various types of decision modeling already exists on micro-based systems and, in many ways, the intimacy of the user interface makes these packages more accessible than mainframe DSS work.

One key way that micro DSS make the user interface more appealing is through the use of graphics. Graphics can be integrated for presentation, as in 1-2-3, Symphony or Ashton-Tate's Framework, or used to speed the linkage between graphics tools and other packages, as with Supercalc and Apple's Lisagraph.

The movement toward mouse/pointing/icon-based interfaces, as typified by the Macintosh software (the long-awaited Lotus Jazz is said to be an excellent example), should lead to systems that can be learned more quickly than previous packages.

In some cases, the graphics itself are part of the interface. In the Vergin system, developed at the University of Pennsylvania, unskilled dispatchers are able to make use of a sophisticated mathematical programming model for optimal vehicle routing. The dispatchers' interface consists of pictures of trucks on a graphical map of customers, with varying colors used to link trucks and customers. Schedule modifications and their impact on total costs and variables such as overtime and

Where program their

If you want to take a look at programming from a different point of view, take a look at a Smart Desk equipped with an IBM 3270 Personal Computer.

The screen of the 3270 PC can be divided into several windows—including multiple PC sessions and up to four host sessions from the same or different computers.



In the blue window you can keep a menu of your function keys. It's easy to log on and connect to a host system for browsing a program listing in the yellow window.

To edit a second program, a single function key can download the source code to a PC session in the red window.



And, when you're finished editing, another function key can send the revised program back to the host.

These multiple windows are available in eight colors. They are ideal for reviewing more than one program at once. Or for the concurrent viewing and testing of source code.



The end result is faster and more accurate programming with less demand on the host.

Any window can be viewed full screen for detailed analysis. Or it can be sized and moved to any area of the screen, so you can create the screen format that works best for you. You also get two handy notepad windows.

And, of course, the 3270 PC is backed by IBM's commitment to service and support.

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lateness of deliveries can all be grasped by glancing at the screen. More such graphically based DSS are likely to be available soon.

Managerial role

MIS managers can play a key role in the use of DSS packages by providing data. Rarely do managers who are using DSS have easy access to the large volumes of current data required by the models they build. In fact, one aspect of the growing use of micros is the increase in computing cycles on mainframes as a result of micro data needs.

Usually, an extract from a real data base is suitable for modeling efforts. It is not necessary to tap into a real-time system for a model whose output is used to guide policies for a one-year horizon. But getting the data into proper format for use on the micro and actually communicating it has not been easy.

Cullinet Software, Inc.'s Golden Gate permits a micro user to build a data request to an IDMS data base interactively. With a heavily menu-driven interface, a user who is somewhat familiar with the data base in question can construct the query and download the Golden Gate spreadsheet. Framework, Peachtree Software, Inc.'s Peachlink and the Answer series from Informatics General Corp. all have similar facilities. They usually download using DIF or Sylk formats acceptable to Visicalc, 1-2-3, Multiplan and others.

Natural-language data base interfaces are becoming available. Clout II, from Microrim, Inc., permits English-like interfaces to its Rbase, Ashton-Tate's Dbase and other data bases and puts the output into DIF format for interface to various DSS.

Training, support, data base maintenance, analysis of offerings and hardware and software selection are ways the manager of the information center can play a role in encouraging effective use of micro-based DSS in large or small organizations. Education in modeling concepts — how to use a spreadsheet and what assumptions to make and not to make in building financial models — can be provided through central facilities.

An emerging problem with the use of spreadsheet models is lack of validation of such models before they are passed on to others. Often, assumptions are not documented in the model, and users who have not built a model may not understand the limits intended by the originator. For example, a model may not include tax tables that vary tax with amount of income; it may merely have used the marginal tax rate appropriate for the specific amounts in the first user's cases. The old Gigo (garbage in, garbage out) rules apply as well to micros as they do to mainframes.

Using the standards of mainframe software development usually does not make sense with micros; the overhead is too large for the effort. However, in the case of building templates that permit later consolidation of results, the information center can perform a service to the company. Here, a budget model can be prebuilt and distributed to end users.

The information center may also have a link program to get current information from the center's data bases into the models. Higher level management can then pull together the departmental models into a corporate budget, with the knowledge that consistent assumptions and labels have been used.

Finally, the center can help users with mundane but often ignored chores — backup of files, models and so on. Micro users seem to believe their floppy disks are invulnerable — until the first disaster.

> ”
>
> *The ability to simulate experience can save millions of dollars in wasted efforts.*

DSS can be of profound benefit to an organization and its management. The ability to learn without doing — to simulate experience — can save millions of dollars in wasted efforts. The "what-if" facilities of DSS give the user an understanding of the sensitivity of a particular decision outcome to variations in a number of input values in a way not feasible without a computer.

Competitive necessity

The use of DSS is becoming a competitive necessity — both internally within an organization and externally with outside competition. Just as today's airlines require reservations systems to keep up, banks require DSS models to bid on large corporate bond offerings.

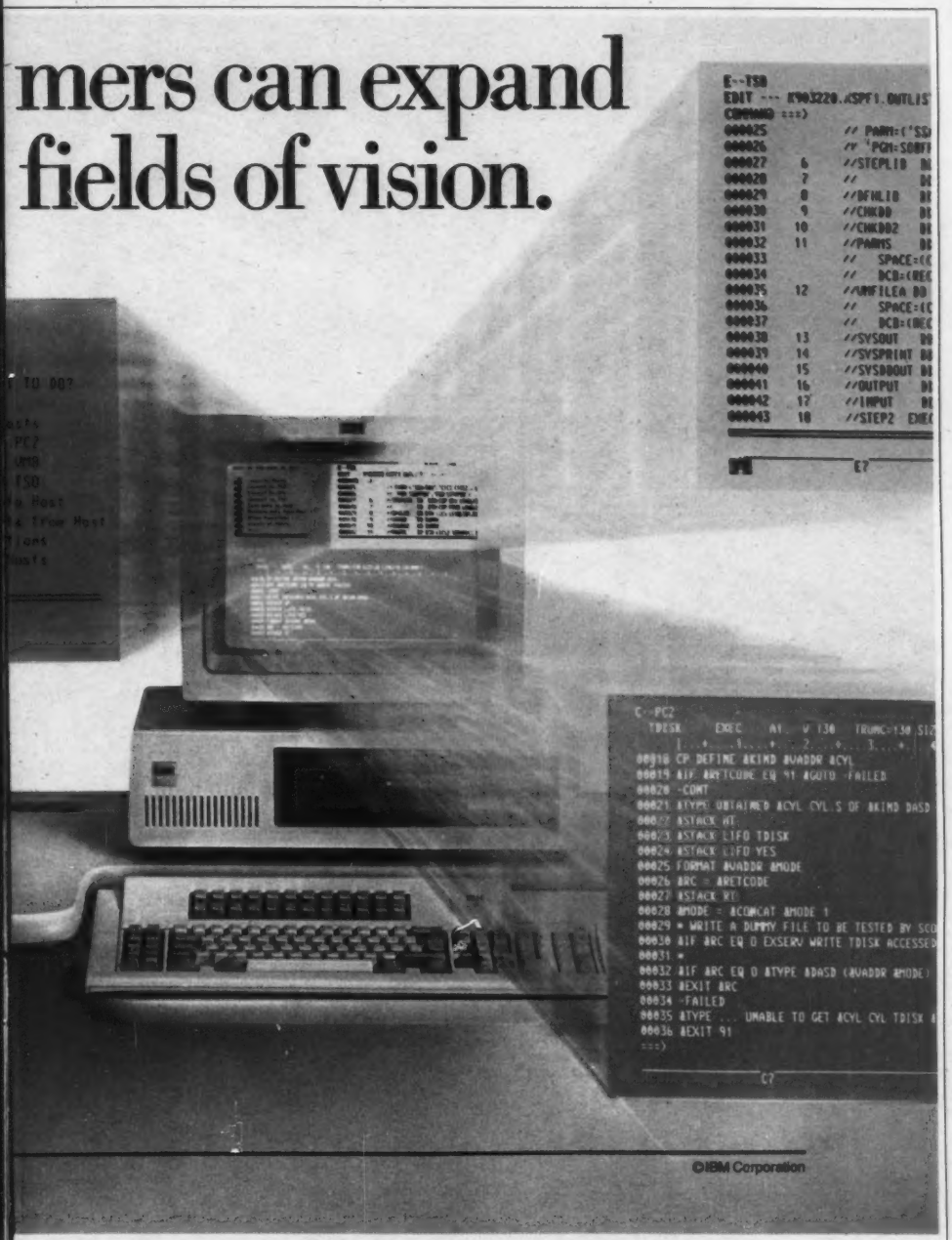
Similarly, within an organization, managers who perform better, aided by DSS, will have the edge over their peers. When DSS can clarify a decision process so that the process can be replicated, decision making can move down in the organization, freeing time at higher levels.

The role of the information systems manager is to make sure that modern tools are used to their maximum advantage to benefit the organization. Although DSS use will spread with or without the assistance of information center personnel, it will be most effective with their guidance, data base resources, training and support. Getting started in micro decision support is a necessary prerequisite to an organization's effective competition in the future. The time to begin is now.

About the author

Howard Morgan is president of Renaissance Technologies Corp. in New York.

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Three more firsts from the people who invented the wheel.



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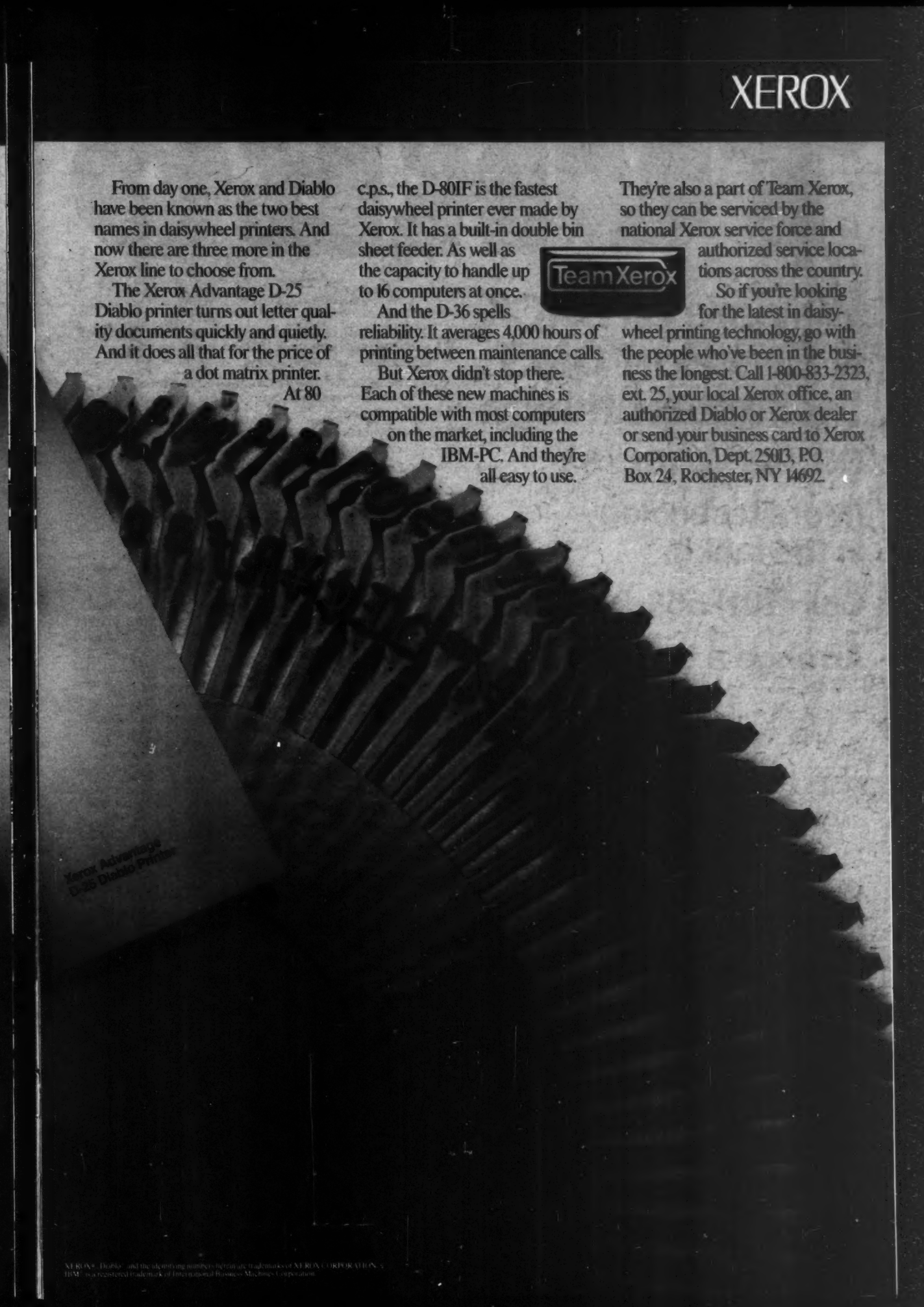
The Xerox Advantage D-25 Diablo printer turns out letter quality documents quickly and quietly. And it does all that for the price of a dot matrix printer. At 80 c.p.s., the D-80IF is the fastest daisywheel printer ever made by Xerox. It has a built-in double bin sheet feeder. As well as the capacity to handle up to 16 computers at once.

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IBM's DB2: An analysis

By now, it should be obvious that IBM's DB2 is going to have a significant impact on the mainframe data base management (DBMS) system market. The fact that DB2 can be accessed through all three MVS data communications systems — TSO, CICS, and IMS/DC — should be of interest to anyone planning for the future with these transaction managers.

DB2 is a major product with many features — more than can be covered in a single article. But a discussion of its status, along with comparisons to IMS/DB, is possible and especially relevant to the experienced IMS developer.

While DB2's impact will be felt initially within the information center in decision support applications under TSO, it will eventually see substantial use in both CICS and IMS/DC environments. Taking the time to investigate DB2 and relational DBMS in general, it should be obvious why this will happen. The list of DB2's advantages is extensive (see chart page 54).

Before continuing, a brief definition is appropriate. A relational DBMS like DB2 is one that users perceive as a collection of tables. Tables in a relational DBMS are no different from other flat file structures. A simple example of a table would be a spreadsheet with its row and column structure and a cell at the intersection of each row and column. Similarly, a

See **DB2** page 54

Pfrenzinger is president of IMS Consulting, Inc., an Encino, Calif.-based consulting firm that specializes in IBM's IMS DB/DC and CICS/DL/1. He has 15 years of data processing experience and is a regular contributor to Softline.

SAS, ISPF link debuts

CARY, N.C. — SAS Institute, Inc., based here, and Morino Associates, Inc., of Vienna, Va., have announced an interactive applications development tool that is said to link the SAS System software with IBM's ISPF. The SAS/DMI software — developed by Morino and marketed by SAS — is scheduled for availability during the fourth quarter.

The SAS/DMI software allows the SAS System's fourth-generation language to implement ISPF applications more quickly than procedural languages such as Cobol or PL/I, according to a spokesman. Users of IBM 370, 30 series or 4300 series machines and compatibles under IBM's OS can convert SAS files to ISPF tables and vice versa.

Prewritten procedures within the SAS System can be used to analyze, display graphically and report on data stored in ISPF. The interface is said to employ the SAS Data facility to develop custom-tailored applications in which entries are verified and information retrieved as the Data facility executes.

The software, which supports both

See **SAS** page 58

IBM upgrades RACF system

WHITE PLAINS, N.Y. — In conjunction with its announcement of an enhanced release of CICS, IBM also introduced an updated version of its Resource Access Control Facility (RACF) security system for MVS and VM. Version 1, Release 7 of RACF offers a variety of new capabilities, many of which IBM said were in response to user-submitted requirements.

The major RACF security enhancements were in the areas of access control to programs, program access to data sets and Dasd erase-on-scratch support. The system is also said to offer users an opportunity to gain back some virtual storage.

In the area of access control to programs, RACF now allows only authorized users to load and execute specified load modules. Improvements to program access to data sets now ensure that authorized users or groups may access specified data sets only while executing certain programs. Erase-on-scratch support gives users the option of invoking the erasure of security-sensitive data extents on Dasd at the time the data is released for reuse.

Other enhancements to RACF include

See **RACF** page 55

SOFTALK
John Gallant
CW Senior Editor

Users unite

Telling users they should participate in users groups is like urging the citizenry to vote.

Users interested in the future of a product, especially a product on which their companies depend, should take an active role in determining that future — just as voters have an obligation to make their voices heard in government. Unvoiced needs often go unmet. That's such an obvious message that many users tend to ignore it. But it is one they would do well to heed.

IBM's unveiling of Version 1, Release 7 of CICS serves as a powerful reminder of the importance of making one's viewpoint known through the very effective channel of a users group.

There was much in the announcement of the enhanced CICS to grab the eyes of users. Major enhancements included the ability to define terminals automatically, a facility that allows users to define resources on-line and improved recovery and restart capabilities. The version also offers users the chance to grab back some much-needed virtual storage.

But perhaps the most significant aspect of the announcement was IBM's explicit acknowledgement of the user input that spawned the changes to CICS — a core product in most IBM mainframe environments. In fact, the opening sentence of the announcement materials — the so-called ivory sheets — stated that "CICS Version 1, Release 7 responds to a large number of user requirements with a range of enhancements that focus on improving [the] productivity of customer data processing personnel."

Deeper into the ivory sheets, IBM said that the enhancement of the transaction manager "addresses numerous user requests and satisfies the . . . requirements submitted by the Guide and Share users groups." Numerous is an appropriate word: IBM listed 56 requirements submitted by both Guide

See **USERS** page 55

■ Integrated Software Systems Corp. introduced software that allows an IBM Personal Computer to act as a mainframe graphics terminal/**50**

■ An integrated systems development environment for Digital Equipment Corp. VAX series and IBM Personal Computer ATs and XTs was unveiled by Promod, Inc./**50**

■ Floating Point Systems, Inc. introduced three software development tools for its FPS-5000 series array processors/**51**

■ Candle Corp. unveiled Version 400 of its Omegamon/CICS real-time performance monitor for IBM's CICS/**51**

■ Uccel Corp. released its Resource Management System for users of Sperry Corp. processors/**52**

INSIDE

Systems Software/**58**

Application Packages/**58**



Informatics to market micro link for IBM CPUs

CANOGA PARK, Calif. — Informatics General Corp. has announced that it will market a version of Micro-Tempus, Inc.'s Tempus-Link — to be known as Alpha/Link — micro-to-mainframe communications product for IBM mainframes running VM/CMS, OS and DOS/VSE and IBM Personal Computer and compatible machines.

A spokesman said that the initial release of Alpha/Link offers the same capabilities as Tempus-Link, with the exception of an added automatic logon facility, the vendor said. A virtual disk residing on an IBM mainframe can be accessed and controlled with all IBM PC-DOS commands from authorized Alpha/Link users.

Alpha/Link supports a variety of communications interfaces that permit access to virtual disks via IBM 3270 terminal emulation devices and remote and local asynchronous TTY.

Alpha/Link consists of three microcomputer floppy disks and a mainframe module. Base price of Alpha/Link is $6,200.

Informatics General is located at 21031 Ventura Blvd., Woodland Hills, Calif. 91364.

Issco mainframe graphics interface for IBM micro bows

SAN DIEGO — Integrated Software Systems Corp. (Issco) has introduced PC Linkagraf, a software interface that reportedly allows an IBM Personal Computer to act as an intelligent mainframe graphics terminal.

PC Linkagraf reportedly allows plots saved on the Personal Computer to be viewed independently of the host. PC Linkagraf also permits hard copy to be produced off-line using devices connected to the Personal Computer.

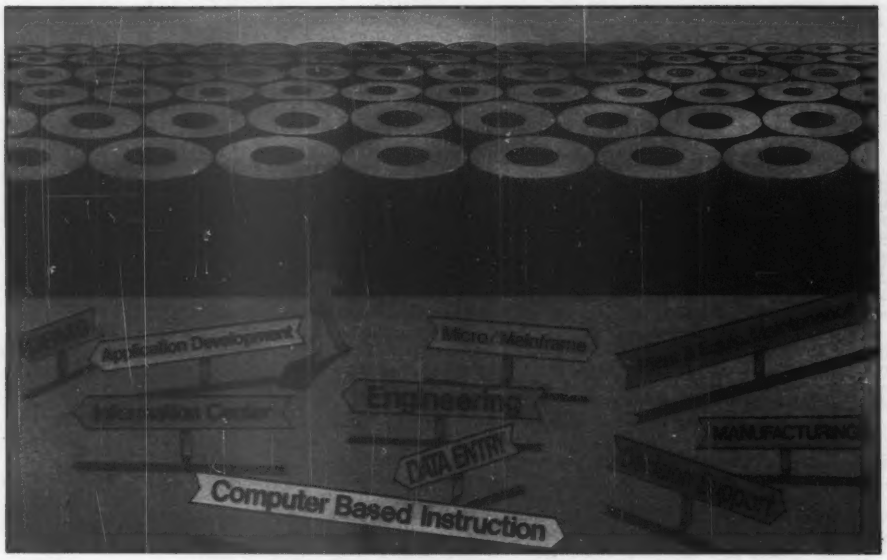
The software is said to include full screen Help functions and support for user-defined function keys. PC Linkagraf enables users to transfer Personal Computer files to and from a mainframe.

The mainframe component of PC Linkagraf is priced from $2,000 to $4,000, depending upon the CPU used. The Personal Computer module is priced at $250.

A corporatewide site license is priced from $250 to $750 per month per mainframe. The license price allows any number of Personal Computers to be connected.

Issco is located at 10505 Sorrento Valley Road, San Diego, Calif. 92121.

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For information about Boeing's other integrated information services —including enhanced remote computing, distributed processing, network services, office automation, consulting, and education and training — call toll free 1-800-447-4700. Or write BOEING COMPUTER SERVICES, M/S CV-26-18B, 7980 Gallows Court, Vienna, VA 22180.

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Software out from Promod

LAGUNA HILLS, Calif. — Promod, Inc. has announced an integrated systems design environment for Digital Equipment Corp. VAX processors and the IBM Personal Computer XT and AT.

The Promod software is said to allow analysis data to be exchanged between the mini and micro systems at any time during the design cycle. Operating independently of the target system and language, Promod integrates structured analysis, modular design and pseudocoding.

The five phases of the Promod design cycle are requirements analysis and definition, based on the Yourdon methodology of structured analysis; transformation from analysis to design, during which Promod automatically creates modules, function descriptions and data types; system design based on modular design concepts; program design based on pseudocode methodology and step-wise refinement; and implementation using code generators to automatically create program templates from pseudocode. Portions of any phase can be accessed for independent analysis, definition and editing of data or graphics.

On the micro, Promod requires 512K bytes of memory and 10M-bytes of hard-disk storage. It supports all DEC VAX systems running under VMS.

Prices for Promod range from $9,950 for the IBM Personal Computer to $37,500 for the DEC VAX-11/780.

Promod is located at 22981 Alcalde Drive, Laguna Hills, Calif. 92653.



"Hey guys — the menu is up!"

CA-Scheduler upgraded

JERICHO, N.Y. — Computer Associates International, Inc. has announced an enhanced version of CA-Scheduler, its production scheduling and management system for IBM MVS operating systems.

Version 7 is said to include an online and menu-driven design for more efficient monitoring of scheduling data. It also incorporates Computer Associates' standards for installation and maintenance and CA-Earl, the vendor's report writer.

CA-Scheduler 7 is available for MVS and MVS/XA and supports IBM's JES2 and JES3. It runs under IBM's TSO, CICS and VM/CMS. The cost of the software is $60,000 for a perpetual license and $40,000 for a three-year lease, according to the vendor.

Computer Associates International is located at 125 Jericho Tnpk., Jericho, N.Y. 11753.

CICS monitor version debuts

LOS ANGELES — Candle Corp. has introduced Version 400 of its Omegamon/CICS real-time performance monitor for IBM CICS transactions.

With the addition of an External Monitoring facility, Omegamon/CICS now allows users to monitor remote CICS sites through IBM's Vtam. The product also includes virtual storage constraint relief capabilities and umbrella transaction support, according to the vendor.

The External Monitoring facility is said to protect Omegamon from CICS transactions containing loops, abends or storage violations.

Version 400 of Omegamon/CICS operates under IBM's MVS/370 and MVS/XA operating systems. The product is available for $23,500.

Candle is located at Suite 2404, 10880 Wilshire Blvd., Los Angeles, Calif. 90024.

Tools out from FPS

BEAVERTON, Ore. — Floating Point Systems, Inc. (FPS) has announced three systems development software products for its FPS-5000 series array processors. The products are said to simplify the code writing process and to allow users to take advantage of coprocessors.

The Fortran 77 compiler allows users to use standard Fortran 77 statements in developing routines and includes a compiler, linker, librarian and debugger. The product allows programmers to use coprocessors by issuing Fortran subroutine calls and allows access to up to 4.75M bytes of system common memory.

Xpal, a coprocessor assembly language, allows users to write their own math library routines when used with a microcode simulator.

In addition, several new math library routines for specific applications use a 128-bit instruction word, accommodating multiple parallel operations and giving the programmer extensive control over data flow.

Prices are $8,500 for the Fortran 77 compiler and $5,000 for Xpal assembly language. Prices range from $975 to $1,275 for the math library routines.

FPS is located at 3601 S.W. Murray Blvd., Beaverton, Ore. 97005.

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Uccel unveils data center management software

DALLAS — Uccel Corp. has introduced the Resource Management System (RMS), a software package for use in Sperry Corp.-based data centers.

RMS, an integrated set of five software packages, reportedly provides management information on data center operations. Its resource accounting module tracks connect time, storage, machine cycles and other system use data. The workload capacity planning module captures system performance and utilization statistics.

The generalized graphics system module displays, through color charts, data center information gathered by RMS.

The problem-tracking system module helps managers follow user, system or data center problems from initial report through resolution. An equipment tracking module maintains an inventory of data center hardware.

The RMS software runs on Sperry 1100 series mainframes.

Its modules cost from $10,000 to $29,000.

Uccel is located in the UCC Tower, Exchange Park, Dallas, Texas 75235.

SI offers software that links System/38, micro packages

ANDOVER, Mass. — Software International Corp. (SI) last week unveiled communications software that links its general ledger package on the IBM System/38 with micro packages on the IBM Personal Computer.

According to a spokesman, Smart Link/38 allows users of the IBM Personal Computer, Personal Computer XT and AT to download information from SI's General Ledger & Financial Reporting System, to manipulate the data with packages such as Lotus Development Corp.'s 1-2-3, Visicalc and Symphony and to upload the information to the host.

The link software is said to offer the same functionality as SI's original Smart Link, which provides data transfer capabilities between the company's IBM mainframe-based software and Personal Computer products. Smart Link/38 provides Help screens and offers the ability to download in real-time either complete files or selected file extracts. The package offers security features and audit trails.

The spokesman said Smart Link/38 also features a library for storing download and upload sessions to eliminate rekeying of data.

Smart Link/38 costs $3,500. It communicates with the System/38 through available IBM 5251 terminal emulation boards.

SI is located at 1 Tech Drive, Andover, Mass. 01810.

Pilot system versions out

BOSTON — Pilot Executive Software, Inc. has announced IBM mainframe and Prime Computer, Inc. minicomputer versions of its Command Center executive information system. The company also introduced three specialized applications designed to run with the product.

Command Center is a host- and microcomputer-based system that allows MIS departments to develop or customize micro-accessed executive information applications. It displays information in both graphics and tabular form.

A version announced earlier this year utilizes Digital Equipment Corp. VAX processors and IBM Personal Computers. The added IBM mainframe version operates under VM/CMS and is priced at $125,000. The Prime version runs on any Prime processor under Primos 19.4 and is priced at $75,000. Both are available immediately.

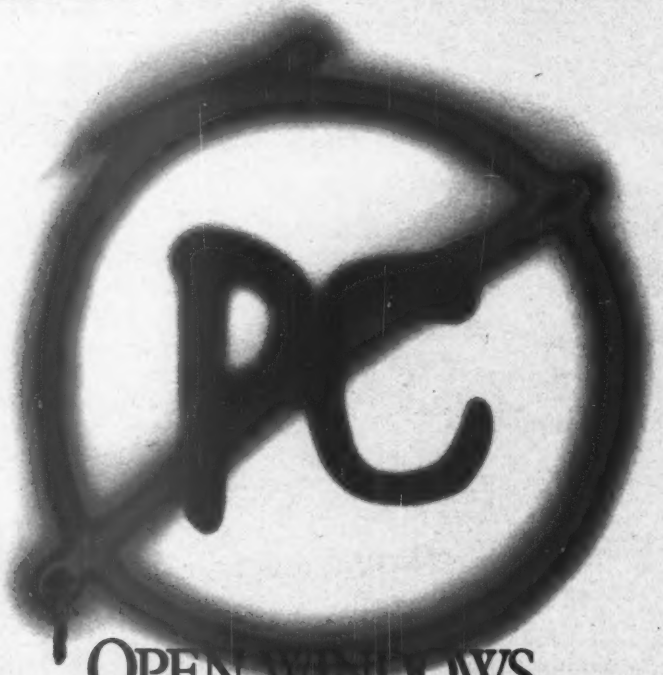
Pilot's application packages allow a user, through a mouse-driven IBM Personal Computer, to access specialized analyses, which are summarized in graphics, text or tabular form. The applications include Competitive Analysis, Corporate Productivity Analysis and Economic Analysis, each priced at approximately $5,000.

Competitive Analysis gives users the ability to review the performance of their company against user-selected competitors. Evaluations are based on raw financial data and other performance measurements.

The Corporate Productivity Analysis package incorporates a variety of value-added, I/O and financial leverage measurements, which are formulated into productivity ratios for comparison.

Economic Analysis allows users to combine economic time series data with internal information to forecast the impact of economic changes on a companywide or industrywide basis.

Pilot Executive Software is located at 40 Broad St., Boston, Mass. 02109.



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SAS Institute Inc. Announces

Lattice C Compilers for Your IBM Mainframe

Two years ago...

SAS Institute launched an effort to develop a subset of the SAS® Software System for the IBM Personal Computer. After careful study, we agreed that C was the programming language of choice. And that the Lattice® C compiler offered the quality, speed, and efficiency we needed.

One year ago...

Development had progressed so well that we expanded our efforts to include the entire SAS System on a PC, written in C. And to insure that the language, syntax, and commands would be identical across all operating systems, we decided that all future versions of the SAS System—regardless of hardware—would be derived from the same source code written in C. That meant that we needed a C compiler for IBM 370 mainframes. And it had to be good, since all our software products would depend on it.

So we approached Lattice, Inc. and asked if we could implement a version of the Lattice C compiler for IBM mainframes. With Lattice, Inc.'s agreement, development began and progressed rapidly.

Today...

Our efforts are complete—we have a first-rate IBM 370 C compiler. And we are pleased to offer this development tool to you. Now you can write in a single language that is source code compatible with your IBM mainframe and your IBM PC. We have faithfully implemented not only the language, but also the supporting library and environment.

Features of the Lattice C compiler for the 370 include:

- **Generation of reentrant object code.** Reentrancy allows many users to share the same code. Reentrancy is not an easy feature to achieve on the 370, especially if you use non-constant external variables, but we did it.
- **Optimization of the generated code.** We know the 370 instruction set and the various 370 operating environments. We have over 100 years of assembler language systems experience in our development staff.
- **Generated code executable in both 24-bit and 31-bit addressing modes.** You can run compiled programs above 16 megabytes in MVS/XA.
- **Generated code identical for OS and CMS operating systems.** You can move modules between MVS and CMS without even recompiling.
- **Complete libraries.** We have implemented all the library routines described by Kernighan and Ritchie (the informal C standard), and all the library routines supported by Lattice (except operating system dependent routines), plus extensions for dealing with 370 operating environments directly. Especially significant is our byte-addressable Unix®-style I/O access method.
- **Built-in functions.** Many of the traditional string handling functions are available as built-in functions, generating in-line machine code rather than function calls. Your call to move a string can result in just one MVC instruction rather than a function call and a loop.

In addition to mainframe software development, you can also use our new cross-compiler to develop PC software on your IBM mainframe. With our cross-compiler, you can compile Lattice C programs on your mainframe and generate object code ready to download to your PC.

With the cross-compiler, we also offer PLINK86™ and PLIB86™ by Phoenix Software Associates Ltd. The Phoenix link-editor and library management facility can bind several compiled programs on the mainframe and download immediately executable modules to your PC.

Tomorrow...

We believe that the C language offers the SAS System the path to true portability and maintainability. And we believe that other companies will make similar strategic decisions about C. Already, C is taught in most college computer science curriculums, and is replacing older languages in many. And almost every computer introduced to the market now has a C compiler.

C, the language of choice...

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The competition...

If you would like to compare, the other vendors of 370 C compilers are: AT&T, Whitesmiths, Ltd., WATCOM Products Inc. (CMS only), Oracle Corp., Amdahl Corp. (UTS only), and IBM Corp. (VM/IX only). We think you will choose the Lattice C compiler from SAS Institute.

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IMS DB and DL/1	DB2 and SQL
Pointers required (pointer-based navigation)	No pointers required (value-based navigation)
Difficult to change	Easy to change
Minimum data independence	Maximum data independence
Segment-at-a-time access (one at a time)	Set-at-a-time access (many at a time)
Programmer interfaces	Programmer and user interfaces
Difficult to understand and use	Easy to understand and use
For predefined systems	For predefined and ad hoc systems
Accessed via IMS/DC and CICS	Accessed via IMS/DC, CICS and TSO
Referential integrity	No referential integrity
High performance	Potential for high performance
Initial load required	No initial load required
Program specification blocks and data base definitions	Catalog

DB2 from page 49

DB2 table is made up of rows and columns with a specific item of data at each intersection. In DB2, these items are called values and cannot be part of a repeating group, that is, they cannot occur more than once.

The term "collection of tables" in the DB2 definition is analogous to a hierarchical structure made up of a collection of segment types. As for the language interface, IBM's SQL is to DB2 what DL/1 is to IMS/DB.

Besides the ease-of-use factor, one of the major benefits of SQL over DL/1 is its set-at-a-time orientation vs. the segment-at-a-time orientation of DL/1. SQL will return one or more rows on a retrieval call, whereas DL/1 will return only one segment on a retrieval call. This would equate in DL/1 to a series of calls, each retrieving a single segment.

For the IMS developer unfamiliar with DB2, there are several additional analogies that can be drawn to help relate a DB2 data base to an IMS data base. One of the comparisons between IMS/DB and DB2 that may be helpful during a conversion, for example, is that each segment type in an IMS hierarchical structure would equate to an individual DB2 table.

In other words, an IMS structure with three segment types would usually convert to three DB2 tables. An individual IMS segment occurrence would equate to an individual row in a DB2 table. A field type in an IMS segment definition would equate to a column, the vertical component of a DB2 table. A field in an individual IMS segment occurrence would equate to a value, that is, data at the intersection of a row and column in a DB2 table. .

Another comparison involves converting a simple two-level hierarchy into DB2 tables. If there is a root segment, called an order header, and a dependent segment, called an order item, the developer would have to create two DB2 tables, one for order headers and the other for order items. In DB2 there are no pointers from rows in the order header table to associated rows in the order item table — as with IMS/DB pointers between segment types — so developers have to add an order number column to the order item table so that DB2 can navigate from one individual order header to its associated order items.

Three issues keep DB2 from achieving success in the production environment of CICS and IMS/DC: poor performance, absence of referential integrity and lack of applications development tools.

The performance issue is one that has received much attention and the conclusion is that rapid index management is the key to achieving high-performance processing. In IMS terms, this equates somewhat to having the same index pointing to several different IMS segment types. Currently, DB2's performance is roughly 50% to 60% that of IMS/DB.

The referential integrity issue must also be addressed. What is referential integrity? It is easier to describe an IMS/DB example than to describe it in DB2 terms. When a root segment in an IMS hierarchy is deleted, dependent segments are also deleted. That is referential integrity. In DB2, if a row in one table is deleted, these same cascading effects are not felt by related rows in other tables.

Referential integrity also dictates, for example, that a purchase order may not be written for a nonexistent vendor and, conversely, that a vendor cannot be removed from the data base if purchase orders are assigned to it.

The lack of DB2 applications development tools is a significant problem. Many of the current productivity tool vendors will find it difficult to mix SQL interfaces and DL/1 interfaces within their products — a necessary requirement during the transitional period when both DBMS will be in use. Cobol-based applications generators have the best chance to combine these two data base interfaces successfully into a single development environment and provide the required development tools for both DB2 and IMS/DB.



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USERS from page 49

and Share and their international counterparts.

Why the recognition of users groups? It's certainly not a common IBM practice to highlight users group efforts in its many product announcements.

Some IBM watchers claimed the recognition was all a marketing or public relations ploy, a sort of "you asked for it, you got it" routine. In part, that's the case. But that view is also an oversimplification.

Most users questioned about the recognition, including some users involved in Share and Guide, felt IBM was trying to stress the importance of user involvement in such organizations. They also claimed IBM was acknowledging that Share and Guide are effective channels for user input.

Considering the sheer number and diversity of its users, even the seemingly omnipotent IBM needs some help in finding out what its customers in the field need.

"I think the users group acknowledgment was very significant," said William Ray, manager of data and network services for Corning Glass Works, Inc. in Corning, N.Y. "It was not a concession on IBM's part but an effort to emphasize its involvement with Guide and Share. It was a way for IBM to say, 'we are listening to you and trying to provide the things you need.' It is a good course for IBM to take."

The users groups, according to Harvey Kramer, senior information systems consultant with Southern California Edison Co. in Rosemead, Calif., also provide an effective method for prioritizing user needs — something the Armonk, N.Y., giant may have trouble doing on its own.

"IBM was clearly showing that it is trying to listen to a vast audience," he said. "I think IBM published that to show everyone that you should be part of a users group and get your voice heard."

'A good business move'

"IBM, despite its size, cannot take care of everybody. But the things that are of high priority to a variety of companies it will address. It's a good business move to take care of as many people as possible, and I think it was smart to show that," Kramer said.

The intent here is not to focus solely on IBM or Guide and Share. For nearly every important product, be it hardware, software or whatever, there is a users group — though an uninterested user may not know it.

Rather, the issue here is involvement. One voice alone may not draw attention. But many voices joined as one can penetrate the walls of even the biggest company.

> ***Perhaps the most significant aspect of the CICS announcement was IBM's explicit acknowledgment of the user input that spawned the changes.***

RACF from page 49

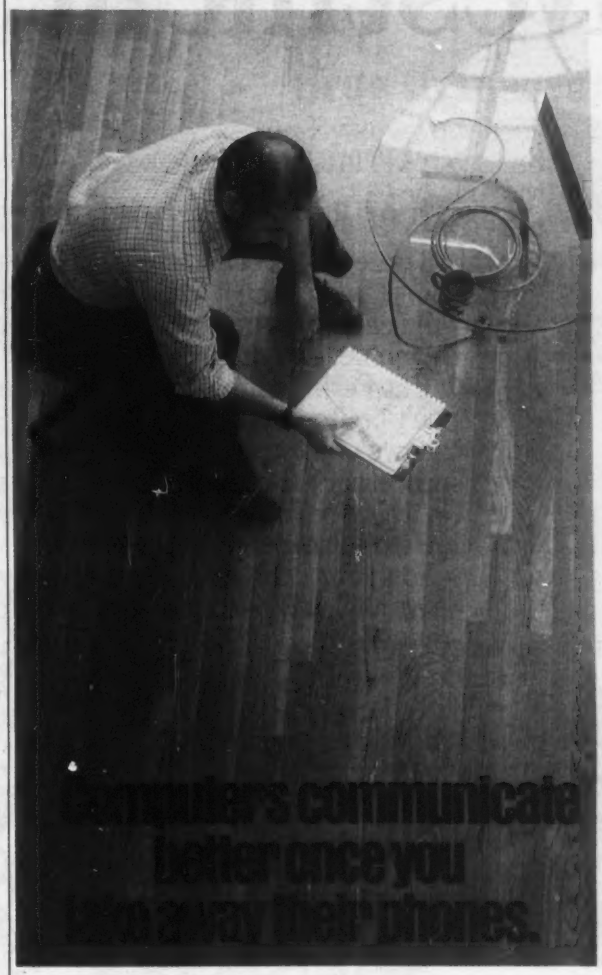
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- Improved VM and JES2 and JES3 support.

RACF extends the security and auditing capabilities of MVS and VM and supplements security provided by other IBM products including CICS, IMS and DB2. RACF Version 1, Release 7 is slated for availability in December. It has a monthly charge of $841.

More information is available from IBM, White Plains, N.Y. 10604





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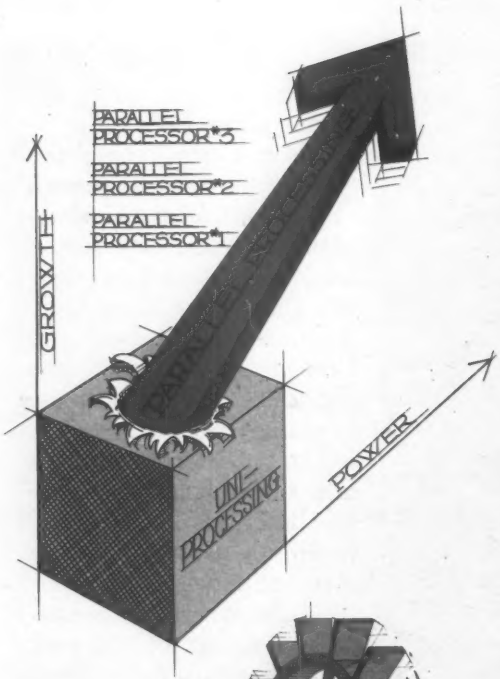
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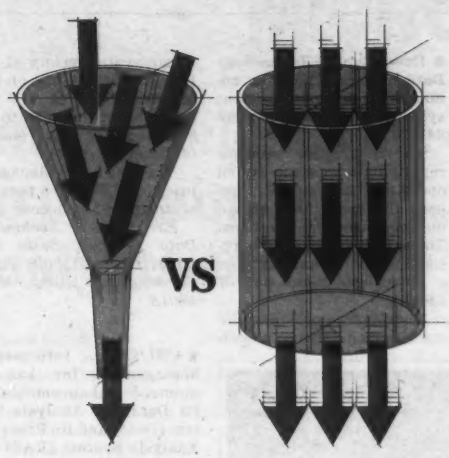
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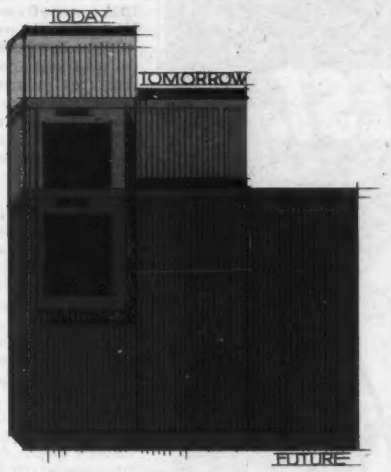
Each Perkin-Elmer real-time processor executes a related segment of your overall task. Simultaneously. So total parallel processing time is far less than sequential uniprocessing of the same task.



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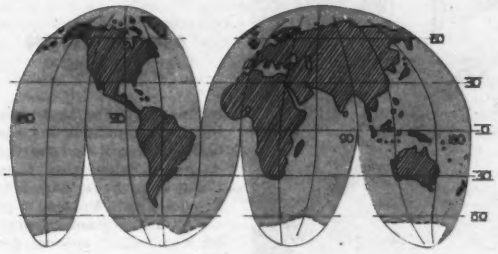
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SOFTWARE & SERVICES

SAS from page 49

batch and interactive processing, allows users to invoke the SAS System directly from the Primary Option Menu of the ISPF Program Development Facility.

First-year license fees cost $8,000 for base SAS software and $4,000 for SAS/DMI software.

More information can be obtained from SAS Institute, Box 8000, SAS Circle, Cary, N.C. 27511.

SYSTEMS SOFTWARE

■ Cosmic, Inc. has announced a set of vector plotting subroutines that runs on Digital Equipment Corp. VAX processors with DEC's VMS operating system.

Longlib consists of a graphics library, an on-line Help library, scan converter programs and command files for installing, creating and testing libraries. The package's features include viewport clipping, graphics input, gray-level and polar plots, three-dimensional plotting and support for hidden line removal.

Longlib produces plots on DEC's VT100, VT125 and VT240; Tektronix, Inc.'s 4010; and Ramtek Corp. 9400 terminals.

Longlib's source code is available for $2,600.

Cosmic, Computer Services Annex, University of Georgia, Athens, Ga. 30602.

■ Executive Technology Data Systems, Inc. has announced a disk management system for the IBM System/34 and 36.

The Disk Space Manager reportedly uses menu-driven operations to identify unused file space and initiate disk management functions. The system can be used to resize files individually or from a system-generated list of files.

The system provides file maintenance functions such as automatic backup of System/36 multiple files on multiple diskettes. It will also generate procedures to restore multiple files from sets of diskettes.

The Disk Space Manager is priced at $395 for a perpetual single-system license.

Executive Technology Data Systems, Suite 108, 28104 Orchard Lake Road, Farmington Hills, Mich. 48018.

■ CHI/COR Information Management, Inc. has announced enhancements to its Data Set Analysis System (Dsas) and its Resource Analysis System (RAS) for IBM mainframes under MVS, MVS/XA or VS-1.

The software defines critical data sets and computing resources required for processing when primary processing facilities are lost.

The highlights of Release 4 of the two products include support for Type 30 SMF records, which can now be used in addition to or in place of Type 4 and Type 5 SMF records to provide job and step data for RAS and Dsas reports. Also offered is support for 3375 Dasd under which the Job Detail Report and the Dasd reports from the RAS will now recognize and report on such devices.

The RAS and Dsas products cost $4,500 and $6,500 respectively.

CHI/COR Information Management, 10 S. Riverside Plaza, Chicago, Ill. 60606.

APPLICATION PACKAGES

■ Financial reporting capabilities, Help facilities and on-line payroll and foreign currency calculation functions have been added to Sysgen, Inc.'s Release 3 of the 38/Accountant integrated accounting system for the IBM System/38.

The 38/Accountant's Flexlist function reportedly provides control over the horizontal columns on financial statements while retaining vertical control of sequencing and subtotaling. The payroll application has been rewritten to speed processing. A security feature allows managers to grant users access to specific options on selected menus of applications.

Accounts payable, accounts receivable, cash management and fixed assets applications can accept foreign currency transactions after input of currency definitions, a vendor spokesman said.

The entire 38/Accountant Release 3 includes 10 modules and costs $63,500. Modules can be purchased separately.

Sysgen, Suite 120, 3001 Academy Drive, Durham, N.C. 27707.



MICROCOMPUTERS

Lotus clones no bargain, analysts say

By Edward Warner
CW Staff

Two low-cost alternatives to Lotus Development Corp.'s 1-2-3 spreadsheet are being readied for market, but at least two analysts believe the packages will offer little to corporate users.

One of the alternatives, Paperback Software International's VP-Planner, reportedly includes two data base management systems, one of them compatible with Ashton-Tate's Dbase II and Dbase III. It also features a spreadsheet that, in the words of Paperback Software's marketing manager Michael Burdick, "will do the things that 1-2-3 does the same way that 1-2-3 does them."

The other, VIP Technologies Corp.'s VIP Professional, reportedly offers the same keystrokes, macro functions, commands and features as 1-2-3, plus an icon-based user interface.

While the two packages, both available in October, claim many similarities with 1-2-3, they differ in price. The Lotus product lists for $495. By contrast, VP-Planner is priced at $99.95 and VIP Professional at $249.95 for the IBM Personal Computer. A $149.95 version of VIP Professional for the Atari, Inc. Atari ST will be available by the end of August.

Will the corporate market for business software be attracted to new entries because of their price tags? "No," answered analyst Aaron Goldberg, director of microsystems services for market research firm International Data Corp. in Santa Clara, Calif. Goldberg characterized the pricing of the two entries as "a perfect example of consumer theory marketing run amok.

"If I'm an executive," he elaborated, "and my company uses 1-2-3, is it worth a couple hundred bucks [saved] to [fool] around [with a new product]?" To do so, he claimed, would be to risk spending hours fixing a spreadsheet if problems arose.

Analyst Amy Wohl, president of Wohl Associates in Bala-Cynwyd, Pa., agreed.

See CHOICE page 67

IBM offers drawing tool

Kit includes art library, multiple brushes, colors

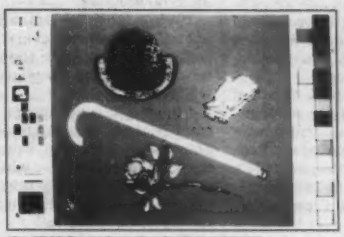
BOCA RATON, Fla. — IBM has boosted its line of Personal Computer Assistant series software with Drawing Assistant, a graphics package that may be used for drawings, floor plans, charts, diagrams and other illustrations.

The $169 package can produce separate drawings, enhance graphs created with IBM Graphing Assistant or produce graphics that can be merged within IBM Writing Assistant documents, IBM said.

Other features reportedly include an art library containing symbols, maps and patterns and a zoom function that allows any part of a picture to be magnified, retouched and then restored to original size.

Drawing Assistant permits users to select or create patterns, choose different brush styles and paint with two to 16 colors at a time, IBM said.

Simplified drawings of shapes such as circles and rectangles can be created by pointing to a function, selecting it and drawing the shape. The package also supports selective removal of a freshly painted drawing, leaving the original painting underneath untouched, according to the vendor.



An IBM Drawing Assistant screen

The software runs on the IBM Personal Computer, Personal Computer XT, Personal Computer AT, Portable Personal Computer and PCjr. It requires 256K bytes of internal memory and either an IBM color graphics monitor adapter or an IBM enhanced graphics adapter. Use of a mouse and two disk drives is recommended.

More information is available from IBM Entry Systems Division, Boca Raton, Fla. 33432.

■ Micropro International formally introduced Easy, a word processing package for first-time users/**60**

■ A terminal emulation board compatible with three micro-to-mainframe standards was announced by Attachmate/**61**

■ A $480 2M-byte add-on board for the IBM Personal Computer debuted from Mega-Omega Systems/**61**

■ Index Technology upgraded its Excelerator automated system development software/**62**

INSIDE

Software/**64**

No leads in search for Unix PC

SMALL TALK
Edward Warner
CW Senior Writer

Call me the Personal Computer Private Eye. For the past month, I've been on the trail of the AT&T Unix PC. I've seen them on display at trade shows and in one computer store, but when I try to find one in somebody's office, no luck.

In May, I asked AT&T public relations people to give me the names of some users. Saying they were too removed from the actual sale, they sent me a list of three dealers instead. I called the dealers on the list, and with the third I hit pay dirt. Or so I thought.

That dealer was Glen Dardick, the owner of the two-store Computerland Corp. of Richmond, Va., chain. Both of his stores carried the Unix PC. Dardick, a straight-talking sort of guy, said he'd give me the names of Unix PC customers, if the customers agreed to it.

So I staked out Dardick's place via phone, checking in every so often. "Sold any yet?" I'd ask. Nope. Last week, I got the word from Dardick: He'd sent all of his Unix PCs back to AT&T. He hadn't sold one since he took delivery in April. "Multiuser software just [is] not out there," and without software a Unix machine won't sell, he lamented.

I'd reached a dead end. Unsure of

See SEARCH page 66

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IBM SQL/DS and DB2 relational DBMS now on PC

ORACLE, the relational DBMS compatible with IBM's SQL/DS and DB2, is now available on the IBM PC/XT and PC/AT. While SQL/DS and DB2 run only on IBM mainframes, ORACLE runs on IBM mainframes as well as on DEC, DG, HP and most other minis and micros. Any application written for SQL/DS or DB2 will run without modification on the complete range of systems supporting ORACLE, including PCs.

SQL/DS and DB2 are relational database management systems; ORACLE is a relational DBMS plus an integrated set of 4th generation software tools for application generation, report writing, color graphics and network communications.

Oracle Corporation introduced the first relational DBMS in 1979. Now, ORACLE provides the only complete implementation of the IBM-standard SQL language available for the PC.

Oracle Corporation cites three principal application areas for its product's capabilities:

■ **The ORACLE Application Development Center** provides a PC-based development center for the creation of DB2 and SQL/DS applications. The flexibility of the personal computing environment is made available to programmers creating applications for use with IBM's relational database products.

■ **The ORACLE Personal Information Center** extends the Information Center concept to the Personal Computer. ORACLE's application generator, graphics, spreadsheet and other end-user tools provide a SQL/DS and DB2 compatible Information Center on the desktop.

Users can become acquainted with the facilities and power of the Information Center in the personal computing environment, and transfer their knowledge and skills as the MIS Information Center facility evolves. The ORACLE Personal Information Center provides the facilities for MIS to develop the cooperative relationship with end users so vital to the success of the Information Center.

In addition, with ORACLE on departmental superminis, users can create identical Information Centers at the department level.

■ **The ORACLE Distributed Information Center** provides an intelligent set of communication links among multiple systems, with ORACLE running on IBM mainframes and various minis and PCs.

Using ORACLE's SQL*LINK networking facility, ORACLE on such diverse systems as MVS, VM/CMS, VAX/VMS, UNIX and PC/DOS can selectively exchange database information using the full capabilities of the SQL language. Applications, portable across all environments, can be run identically on any system, and data can be intelligently extracted for use at any site.

ORACLE is currently installed on over 1000 supermini and mainframe systems around the world, as well as on thousands of PCs and compatibles. Oracle's customers include 8 out of the 10 largest U.S. corporations, as well as major foreign companies and many government agencies.

For further information, contact Oracle Corp., Dept. C, 2710 Sand Hill Rd., Menlo Park, CA 94025, or call 415/854-7350.

Micropro word processing package targets novice users

By Kathleen Sullivan
CW West Coast Bureau

SAN RAFAEL, Calif. — Setting its sights on the market for novice computer users, Micropro International Corp. recently announced Easy, a $150 word processing package designed for first-time users.

Developed for the IBM Personal Computer and compatible systems, Easy signals Micropro's intent to woo customers away from Software Publishing Corp.'s PFS:Write and IBM's Writing Assistant, which now dominate the market, said H. Glen Haney, Micropro's president.

Designed primarily for small business users, Easy is a menu-driven program that relies extensively on the use of pop-up menus. On-line Help is provided for every command, and Easy includes an Undo command that allows users to restore accidentally deleted text, according to Micropro.

Documents up to 240 columns wide

With Easy, users can create documents up to 240 columns wide. The program is said to provide seven type styles and to feature customized support for more than 120 printers. A 65,000-word spelling checker is included.

> ”
>
> *At its product debut, Micropro emphasized that Easy is not a 'cut-down version of Wordstar' but an entirely new product.*

According to Micropro, Easy users will be able to share files with the firm's two other word processing programs, Wordstar and Wordstar 2000.

Unlike competing products that limit the length of a document, Easy's documents are limited only by the amount of disk storage available. PFS:Write writes to random-access memory (RAM), so a document is limited to available memory.

At its product debut, the company emphasized that Easy is not a "cut-down version of Wordstar" but an entirely new product, written in the Modula-2 programming language.

User interface applauded

Analysts who had received early copies of the program applauded Easy's user interface, saying that the program's design gave it some advantages over products with which it competes.

In a report issued by Wohl Associates, a Bala Cynwd, Pa.-based consulting firm, analyst Amy Wohl and Joel Levy compared Easy and PFS:Write.

The analysts decided that while the products were "roughly comparable from a features point of view," Easy got higher marks in the ease-of-learning category.

"We found that the Easy product, because of its pop-up menu interface and its contextual Help, was particularly simple to learn," they wrote. Wohl and Levy estimated that a new user would be able to master the basic features of the program and begin producing simple documents within 30 to 60 minutes.

"While the functionality would not be adequate for every word processing job, it is more than adequate for new users and casual users," they wrote.

"Since the package is upwardly compatible with a range of more sophisticated Micropro word processing products, users whose needs grow should be able to upgrade without the need to convert their existing library of documents."

Easy also got high marks from International Data Corp.'s Yates Laboratories, a market research and software testing group based in Palo Alto, Calif., which brought three novice users together to compare Easy, PFS:Write and IBM's Writing Assistant.

A Yates report noted that all three programs are "quite simple to learn and use," but added that "an overriding advantage which Easy has over its two competitors is the high level of comfort which the users felt with the program.

"This feeling of comfort makes the new user's first impression of using a computer a rewarding one, rather than a frustration." Yates concluded that Easy has a shorter learning curve than the other products.

Although Micropro said Easy can run on a dual-floppy-drive system, Yates recommended the use of a hard disk with the program. "Easy, in certain functions, seems slow on a two-disk system," the report said. "There is considerable disk activity when moving from menu to menu, and a few editing operations, such as inserting text into a paragraph, lag slightly behind the user."

Easy, which requires 256K bytes of RAM, runs under PC-DOS 2, 2.1, 3 and 3.1.

It will be available late this month, the vendor said.

Additional information is available from Micropro, which is located at 33 San Pablo Ave., San Rafael, Calif. 94903.

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The Macworld Exposition has a targeted schedule designed to fit your busy schedule. As a dealer, a distributor, a retailer, a business user, or an educator, the three-day conference and exposition is designed for you.

Day one is for dealers, distributors, retailers, and other third-party vendors to talk to Apple and the 100+ exhibiting companies about their products.

Days two and three are specifically geared for people interested in the Macintosh as a tool for business and anyone else interested in the Mac.

Who should attend?

Industry: Dealers, distributors, retailers, wholesalers, manufacturers, systems houses, consultants, technical programmers, all other ISOs
Business: CEOs, presidents, vice presidents, managers, comptrollers, owners/partners
Professionals: Doctors, nurses, bankers, lawyers, engineers, stockbrokers, real estate and insurance agents, CPAs, consultants
Education: Administrators, faculty, students

Here's a look at some of the conference sessions designed for you:

- The Outlook for the Mac in the Office
- Developing Software for the Macintosh
- How to Start and Survive in Business with a Macintosh
- Maximizing MacPaint™
- The Mac Clinic
- A Guide to Better Business Graphics
- Maximizing MacWrite™
- Database Management for the Macintosh
- Getting the Most Out of Spreadsheet Programs
- How to Get Your Programs Published
- What's Available in Mac Software
- File Management Tips and Techniques
- Maximizing Macintosh Disk Storage
- The Mac in the Classroom
- The Mac in Higher Education
- Developing University Courseware with a Macintosh

Attachmate introduces 3-N-1 adapter

BELLEVUE, Wash. — Attachmate Corp. has announced the Attachmate 3-N-1 3270 Coaxial Adapter, a $1,195 micro-to-mainframe board that offers compatibility with the Digital Communications Associates, Inc. (DCA) Irma board, the IBM 3278/3279 Emulation Adapter and the Multisession Adapter used in the IBM 3270 Personal Computer, according to the vendor.

A company spokesman predicted that IBM soon will offer a variety of software packages for its 3278/3279 Emulation Adapter and the 3270 Personal Computer AT, and emphasized that the Attachmate product is a commitment to the IBM interface standard embodied in those upcoming offerings.

As a single-board adapter for an IBM Personal Computer, Personal Computer XT, AT or compatible, the Attachmate 3-N-1 supports the IBM Type 2 coaxial protocol and the 3270 data stream commands in a CUT or DFT environment.

A range of software

The Attachmate 3-N-1 operates with software currently available for the Irma board and the 3278/3279 Adapter, and it comes with a range of its own software as well.

Features of the Attachmate Operational Software include IBM 3270-PC-compatible file transfer and concurrency.

Software compatible with the 3-N-1 includes DCA's E78 Terminal Emulator and File Transfer packages, Cullinet Software, Inc.'s Goldengate micro-mainframe link, Information Builders, Inc.'s PC/Focus, McCormack & Dodge Corp.'s PC Link and IBM's Professional Office System, PC Connection and 3270 Attachment.

The 3-N-1 fits into a single slot in the Personal Computer and attaches it to IBM 3274 and 3276 control units and 4300 mainframe processors.

The product offers IBM 3287 printer emulation and 3270-PC compatibility in IBM TSO, CMS and CICS environments.

Attachmate is located at 3241 118th S.E., Bellevue, Wash. 98005.

computer show the Macintosh™



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A+/Ziff-Davis Publishing Co.
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Blue Chip Software
Boston Software
Brain Power, Inc.
Cadmus Computer Systems
The Cobb Group
Communications Packaging Corp.
Computer Additions
Computer Identics
Computer Learning Systems
Computer Shopper
Computer Software Designs, Inc.
The Computer Store
Corvus Systems, Inc.
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Creighton Development, Inc.
Diablo Valley Design
Diversions, Inc.
EDP Supply North
Enterset
Esoft Enterprises
ExperTelligence
Express Computer Supplies
First Byte, Inc.
Forethought, Inc.
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General Computer Company
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Hayden Software
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MACWORLD EXPOSITION
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Mega-Omega board debuts

DALLAS — Another vendor cast its lot with the Lotus Development Corp./Intel Corp. Expanded Memory Specification (EMS) in July as Mega-Omega Systems, Inc. introduced its $177 Companion Card, an option board that can be configured to boost the IBM Personal Computer's memory up to 2M bytes, the vendor said.

A 2M-byte version of the Companion Card costs $480.

One main competitor in the EMS arena, Intel's Aboveboard/PC, cost $395 with 64K bytes of memory at its introduction in June. Aboveboard/PC is also said to be expandable to 2M bytes, using additional memory chips sold by Aboveboard dealers at the dealers' prices.

Allows IBM micros to address memory

The EMS permits Personal Computers to address memory beyond the 640K-byte limit imposed on the machine by its single-user operating system.

Companion Card reportedly also fills in the Personal Computer's memory below the 640K-byte limit, if required.

Like Aboveboard, the Companion Card will work with Lotus' 1-2-3 and Symphony packages, Ashton-Tate's Framework and other applications software, according to vendor.

With the use of an optional battery backup unit, the Companion Card reportedly can act as a nonvolatile random-access memory disk.

Memory from 0 to 2M bytes

Companion Card is available with zero to 2M bytes of memory and costs $177 to $480, depending on the amount of memory.

Companion Card Plus, a version of the Companion Card with serial, parallel and game ports and a real-time clock, was also introduced.

Companion Card Plus, which uses one option board slot, costs $297 to $600, depending on memory, and is available with zero to 2M bytes of memory.

Mega-Omega Systems is located at Suite 710, LB 122, 5217 Ross Ave., Dallas, Texas 75206.

TI micros get programs, kit

CULVER CITY, Calif. — Ashton-Tate has begun shipments of its Dbase III and Framework programs for the Texas Instruments, Inc. TI Professional line of personal computers, the two vendors have announced.

TI has also announced that it will market a $200 kit to allow users of the TI Professional version of Ashton-Tate's Dbase II to upgrade to Dbase III.

The kit will be available from TI and its authorized resellers, according to the vendors.

Dbase III and Framework for the TI Professional each cost $695.

Ashton-Tate is located at 10150 W. Jefferson Blvd., Culver City, Calif. 90230.

Index Technology enhances Excelerator development tool

CAMBRIDGE, Mass. — Index Technology Corp. has enhanced Excelerator, its automated system development methodology that runs on the IBM Personal Computer line.

The version supports Jackson structure diagrams, entity relationship data model diagrams and Yourdon data flow diagrams. Another capability is a dictionary interface facility that controls locking, unlocking, importing and exporting of project files.

The software's audit trail automatically tracks changes to every dictionary entry. Entity lists keep entity names and types that are logical subsets of a project.

The firm added two graphics enhancements to Excelerator. Level-to-Level Balancing report verifies the conversion of data flow by comparing a graph and all its lower levels. An Explosion report creates a hierarchical table of contents, listing up to nine levels to which objects in a graph can explode.

The release adds 78 ways in which a user can record relationships among entities in a project.

Excelerator costs $8,400.

Index Technology is located at Five Cambridge Center, Cambridge, Mass. 02142.

AST adds video adapter to hardware/software line

IRVINE, Calif. — AST Research, Inc. has announced the addition of the AST-5250/Display video adapter to its Model 11 line of hardware/software packages for communication between IBM Personal Computers and IBM Systems/34, 36 and 38.

The AST-5250/Display board reportedly makes it possible for a Personal Computer to support all IBM 5251 Model 11 terminal character and field display attributes on a standard IBM monochrome monitor.

The single-board AST-5250/Display also reportedly includes a parallel printer port and offers a Hercules Computer Technology, Inc.-compatible graphics display mode. The board is said to be compatible with such packages as Ashton-Tate's Framework and Lotus Development Corp.'s 1-2-3 and Symphony.

The product is said to include the ability to switch automatically from 5251/11 display to IBM PC-DOS display without operator interaction. Also supported are column separators as used in many IBM System/34, 36 and 38 applications.

The AST-5250/Display costs $495.

AST Research is located at 2121 Alton Ave., Irvine, Calif. 92714.

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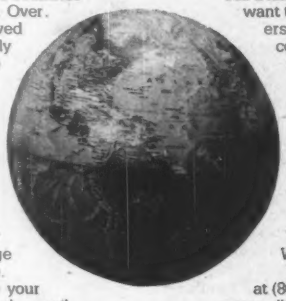
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Multimate products out

EAST HARTFORD, Conn. — Multimate International Corp. has introduced a word processing keyboard and a communications board that includes file conversion utilities to transfer documents between personal computers running its word processing software and Wang Laboratories, Inc. Office Information System, VS and Alliance systems.

The Multimate Business Advantage Keyboard is said to enhance the functionality of Multimate's Professional Word Processor software for IBM Personal Computers. The keyboard has 33 more keys than the IBM keyboard and includes reprogrammed function keys to offer up to four functions per key, the vendor said. It also provides color-coded key labels to remind users of Multimate commands.

Sixteen programmable function keys can be reassigned by the user for macro combinations of Multimate commands.

Sets of function key macros can be created, saved and loaded from the disk for use with different applications or other software.

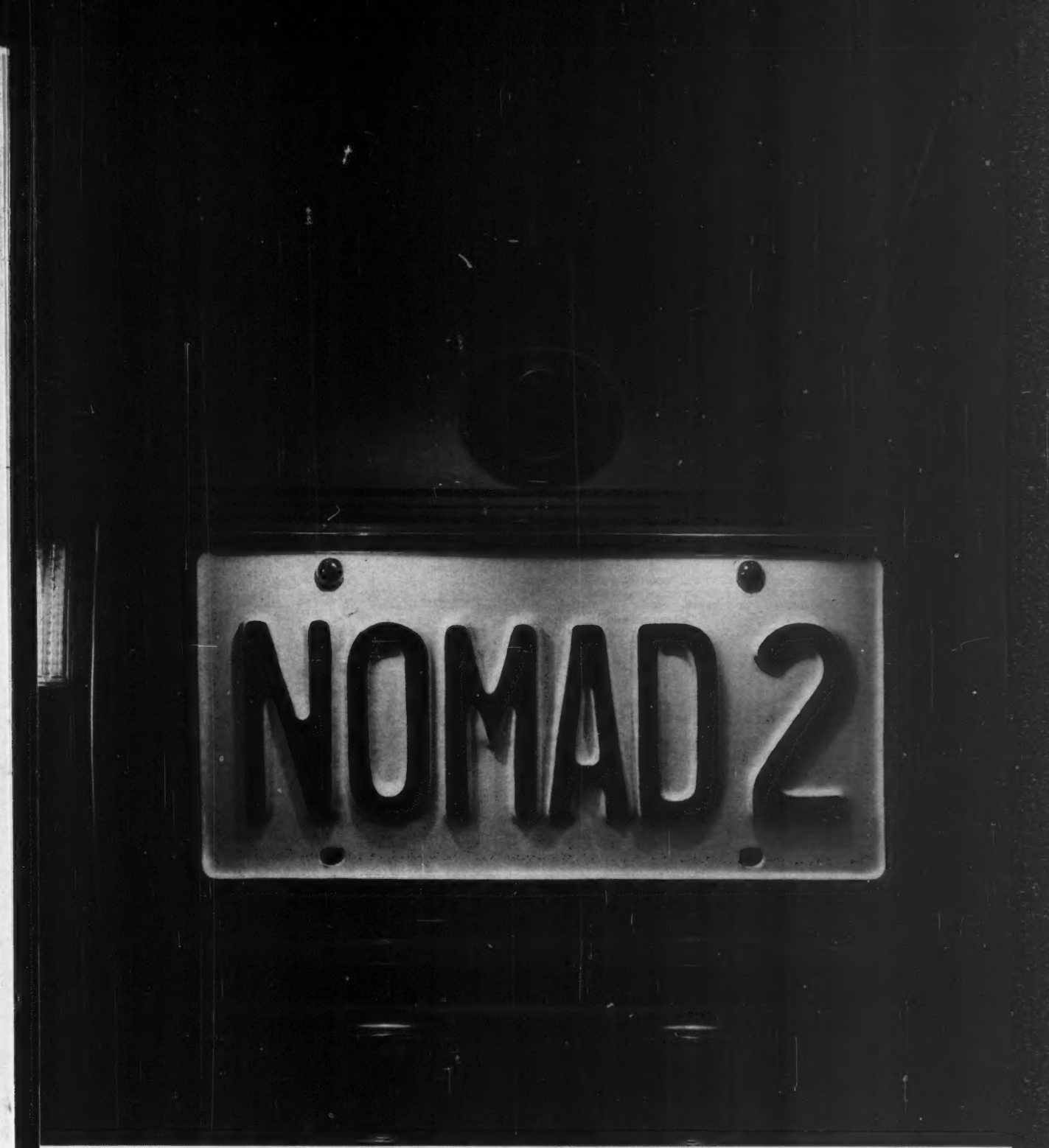
The Business Advantage Keyboard will be available in October for $345.

Multimate's Business Advantage Communications Board is a dual-function communications board. Its word processing file conversion capabilities reportedly allow bisynchronous transfer of documents between microcomputers using Multimate and Wang dedicated word processors or asynchronous communication with printers, modems and other peripherals.

To transfer files, users can install the communications board in the personal computer and connect it to Wang's communications port directly or through bisynchronous modems and telephone links. File transfer is handled with error-checking capabilities and can conform to Wang's modifications to the IBM 2780 bisynchronous protocol, according to the vendor.

The Business Advantage Communications Board is priced at $995.

Multimate International is located at 52 Oakland Ave. N., East Hartford, Conn. 06108.



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Ashton-Tate utility tool debuts

INGLEWOOD, Calif. — Ashton-Tate has introduced a desktop utility program and a file encryption program for the IBM Personal Computer, Personal Computer XT, AT and compatible machines.

Timeframe is a collection of utilities designed to run with Ashton-Tate's Framework integrated software, the vendor said. Designed by Enabling Technologies in Chicago, Timeframe features an appointment book function, calendar, calculator and office assistant capabilities including a directory, letter writer, mail merge and mailing label function. The product is priced at $39.95.

Framelock is a stand-alone program that reportedly will encrypt files that can be read by the Personal Computer or compatibles. It includes two levels of security, password protection and a chain block cipher capability. Framelock requires a minimum memory of 320K bytes and costs $39.95.

Ashton-Tate is located at 8901 S. La Cienega Blvd., Inglewood, Calif. 90301.

Kit lets IBM micro users upgrade to 1-2-3

CAMBRIDGE, Mass. — IBM Personal Computer users of Lotus Development Corp.'s Visicalc spreadsheet package can upgrade to 1-2-3 under an exchange program announced in late July.

Lotus, which acquired the rights to Visicalc through its purchase of Software Arts, Inc., said it will sell $250 exchange kits through its authorized dealers. Visicalc users can buy the kits, complete the enclosed materials and then mail their Visicalc documentation and software to Lotus. They will receive a copy of 1-2-3 via an overnight delivery service, Lotus said.

The exchange program reportedly covers those versions of Visicalc for the Personal Computer marketed by IBM, Software Arts and Visicorp. The 1-2-3 software requires 256K bytes of internal memory, IBM's PC-DOS Version 2 or later and two double-sided, double-density diskette drives or one such drive and a hard-disk storage unit.

Lotus is located at 55 Cambridge Pkwy, Cambridge, Mass. 02142.

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There's also a choice of system software to consider. Gould's unique UTX/32® is the first operating system to combine UNIX® System V with Berkeley BSD 4.2. So it allows you to access virtually any command format you want whenever you want.

And in real-time environments, Gould's MPX/32™ operating system offers performance that's unmatched in the industry, as well.

Delivery that's right on the mark.

Unlike the VAX 8600, that has up to a 12 month wait for delivery, when you order either a Gould PowerNode or a CONCEPT/32 system, they'll be shipped within 90 days ARO.

You can also be sure with Gould you're getting a computer that's backed by years of experience – the kind of experience we used to develop the first 32-bit real-time computer.

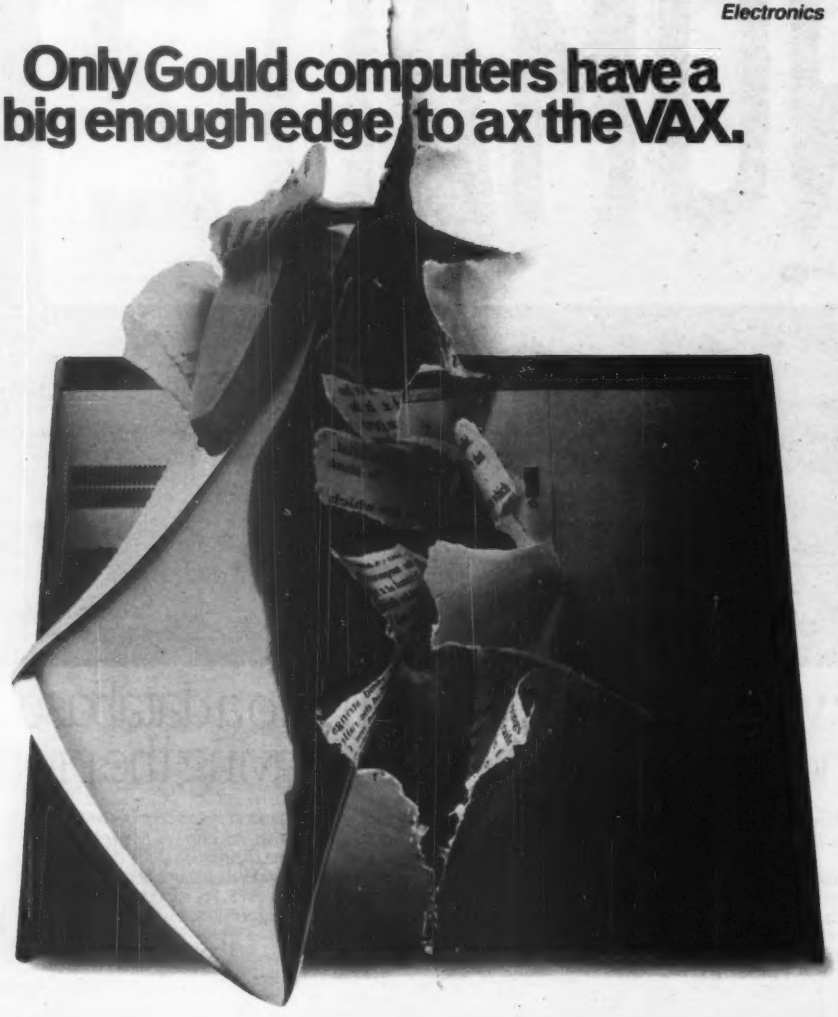
If you need more information or just have a few questions, give us a call at 1-800-327-9716.

See for yourself why VAX no longer cuts it. Go with a Gould computer and ax the VAX.

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GOULD
Electronics

Only Gould computers have a big enough edge to ax the VAX.



Reflex net version out

FREMONT, Calif. — Analytica Corp. has announced a network version of its Reflex data base management software package for the IBM Personal Computer.

The network version, which runs on 3Com Corp. Etherseries networks, is priced at $1,495 per server. Deliveries will begin in September, according to the vendor.

More information is available from Analytica at 3155 Kearney St., Fremont, Calif. 94538.

SOFTWARE

■ STSC, Inc. has enhanced Pocket APL, a version of the APL programming language that runs on the IBM Personal Computer line.

The enhancements include support for larger file sizes, which are now limited only by disk space. Pocket APL features report formatting, error trapping, native and APL shared file systems, online Help and more than 50 system functions, according to STSC.

The package also features an expanded reference guide that includes detailed descriptions and examples of system functions.

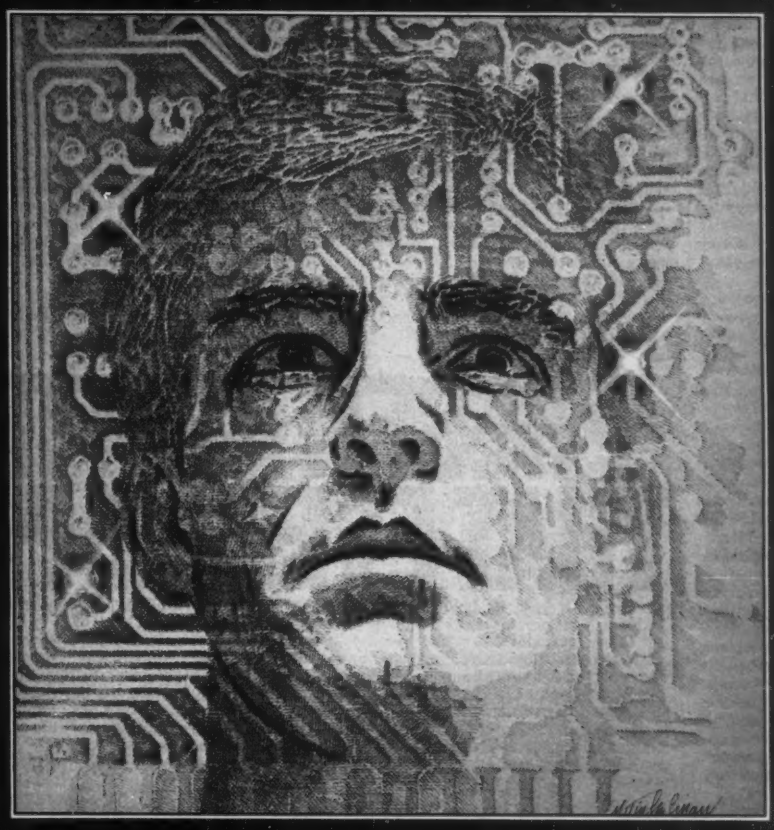
The programming language requires 128K bytes of random-access memory.

Pocket APL sells for $95.

STSC, 2115 E. Jefferson St., Rockville, Md. 20852.

See **SOFTWARE** page 66

INTRODUCING THE



"FRIENDLY SUPERPOWER"

Advanced Business Software That's on Speaking Terms with You!

Power or ease of use ... until now, you had to choose. The more you had of one, the less you had of the other.

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KNOWLEDGE man/2

THE UNIVERSAL KNOWLEDGE MANAGEMENT SYSTEM

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mdbs

SOFTWARE from page 64

■ **Wiley Professional Software has announced a software training program for users of Computer Associates International, Inc.'s Microproducts Division Supercalc 3 Release 2 spreadsheet program on the IBM Personal Computer and Personal Computer XT or AT.**

"Supercalc, The Next Generation," reportedly explains the syntax of all commands and illustrates how to customize text and formulas, move information, manipulate data and print or save the work. The product includes a runtime version of Supercalc 3 that allows users to test its features but does not permit saving or printing data.

The Wiley product requires one 360K-byte disk drive, 128K bytes of memory and the IBM PC-DOS 2 or Microsoft Corp. MS-DOS 2 operating system. The package costs $46.95.

Wiley Professional Software, 605 Third Ave., New York, N.Y. 10158.

■ **Phoenix Computer Products Corp. has announced a macro assembler for microcomputers running Intel Corp.'s 8088, 80186 or 80286 processors and either Microsoft Corp.'s MS-DOS or IBM's PC-DOS operating system.**

Pasm86 is said to transform source code into object code in half the time of Microsoft's assembler. Pasm86 allows users to include local symbols within procedures, define symbols on the command line and obtain listings of error lines only, the vendor said. It can also assemble modules created by the Microsoft product and enables users to include files from any subdirectory by specifying the subdirectory on the command line.

Pasm86 defines relative offsets for each line of source in the first pass and can generate the listing, object and cross-reference file in the second pass. Listings can be generated on the first and second pass or on the second pass only.

Pasm86 is priced at $295.

Phoenix Computer Products, Suite 220, 1416 Providence Highway, Norwood, Mass. 02062.

■ **Texas Instruments, Inc. has announced an architectural design template package that runs on its Professional microcomputer.**

AE/Cadd is a set of template commands used with Autodesk, Inc.'s Autocad software. The template fits over an 11- by 11-in. digitizer tablet and contains common symbols and objects, the vendor said. Rather than continually redrawing a figure, architects can locate a desired shape and insert it into a drawing on their monitors.

AE/Cadd requires 512K bytes of random-access memory, an Intel Corp. 8087 coprocessor, a hard disk drive, color monitor, digitizer tablet and Microsoft Corp.'s MS-DOS operating system.

The package costs $1,000.

TI, Data Systems Group, Department H-802, P.O. Box 809063, Dallas, Texas 75380.

■ **Micrografx, Inc. has announced computer-aided design and drawing software that can run alone on the IBM Personal Computer, Personal Computer XT or AT or in conjunc-**

Continued on page 67

SEARCH from page 59

what to do next, I pulled the bottle of root beer out of my desk drawer and took a swig. As I was putting the bottle back, my eyes fell on an open *Wall Street Journal*. There I saw my next lead — an ad listing authorized AT&T PC dealers in New York and New England.

I called seven stores, in cities ranging from New York to Danbury, Conn., before I came upon one that was selling the Unix PC. That store, Computerland of Fort Lee, N.J., had sold only a few. Of those few, several had been sold to employees of AT&T itself, according to Paul Allessi, store manager. "People at AT&T have been buying the machines because they can't get them internally," Allessi speculated. But Allessi couldn't give me any names.

I made a few more calls. The score, when I gave up on the list, was seven "No" answers to three "Yes" answers; most AT&T dealers, it appeared, weren't carrying the machine.

In desperation, I called AT&T again. This time, a spokeswoman said she'd have no problem getting back to me with users. Could I give her until Wednesday?

Late on Wednesday, just as I was about to grab my hat and head for home, the phone rang.

"Sorry, but I don't have any users for you yet," she said, adding that she wasn't sure now whether she could ever get me some.

I hung up the phone and did some thinking. Can it be that after five months of selling Unix PCs, AT&T can't name one customer who is currently using the machine?

Sure, they've gotten big orders for Unix Personal Computers from such disparate groups as the Shearson Lehman Brothers, Inc. brokerage firm and the National Catholic Group Purchasing Association, but those orders won't be filled until this fall.

I wanted some users now, while people were still wondering about what impact the machine might have on U.S. business.

If I wanted Unix PC users, I decided, there was only one place left to go for answers. So, readers, do *you* know of anyone who is using the Unix PC in an office, or evaluating the machine for a possible large purchase? If you do, give me a call at 617 879-0700, extension 538). Please call soon; even the Personal Computer Private Eye can't stay on the case forever.

PRESENTING THE MOS THAT EVER HAPPENED

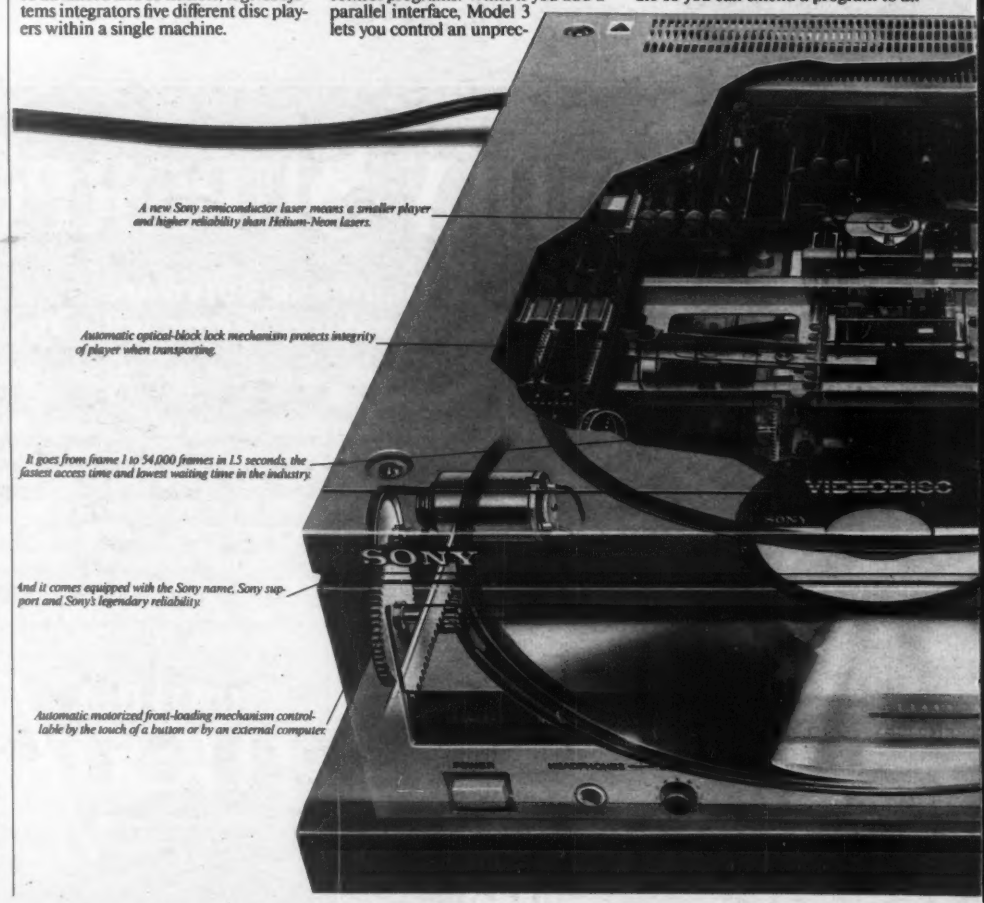
INTRODUCING THE LDP-2000 SYSTEM VIDEO DISC PLAYERS.

In one masterful stroke, Sony has just raised its Intelligent Video™ systems from smart all the way to genius.

We created the LDP-2000, a player for standard LaserVision discs that's so advanced and so flexible, it gives systems integrators five different disc players within a single machine.

Model 1 provides random access audio/video with an RS-232C external computer interface. Add an expansion board, and Model 2 gives you the ability to play discs with audio-track control programs. While if you add a parallel interface, Model 3 lets you control an unprecedented 15 players through one communications bus.

With Model 4, you're equipped with the perfect educational tool: Still Frame Audio. It compresses digital audio so you can extend a program to an



CHOICE from page 59

"The whole problem with inexpensive software products is that they don't allow for proper support," Wohl said. Singling out VP-Planner, she said, "There are real questions about whether you can properly support a package for $99 and have any margin for dealers." No dealers means no local support, she said.

Wohl also expressed what she called mixed emotions about the ability of upstart software publishers to follow a trail blazed at some risk by Lotus. "Somebody did the work to [create] 1-2-3," she said. "If you know what the end result should look like, it's easier to do the programming."

The icon-based VIP Professional reportedly offers users the ability to interact with the software using either their keyboards or an optional mouse. It will interact with those programs that interface with 1-2-3. Versions of the package will eventually be marketed for Apple Computer, Inc. Apple II and Macintosh machines and for computers under the AT&T Unix multiuser operating system, VIP said.

> *'There are real questions about whether you can properly support a package for $99 and have any margin for dealers.'*
>
> — Amy Wohl
> Wohl Associates

VP-Planner's templates, macros and worksheets reportedly are all compatible with 1-2-3. The product can work with files imported from the Lotus spreadsheet, Burdick explained, but it cannot export files for use in 1-2-3. That one-way file format compatibility is due, he said, to the fact that 1-2-3 is a subset of VP-Planner, and its compatibility is limited by the features that it offers beyond those of the Lotus product. These features include the ability to print a file in the background while the user works on another spreadsheet.

VP-Planner reportedly can create, read, write, update and join files that are compatible with Dbase II and III. The number of Dbase files that can be open at one time is limited only by disk capacity and the amount of memory available for the worksheet that is accessing those files.

A second data base system included in VP-Planner, the Multidimensional Database, reportedly stores information from worksheets in a data base format that can be used to calculate any combination of totals and subtotals, according to the vendor.

VP-Planner reportedly will be available next month and requires at least 256K bytes of memory, one diskette drive and an 80-col. monitor.

Paperback Software International is headquartered at 2612 Eighth St., Berkeley, Calif. 94710. VIP Technologies is located at 132 Aero Camino, Goleta, Calif. 93117.

T INTELLIGENT THING TO INTELLIGENT VIDEO.

incredible 15 hours per video disc side.

And in Model 5, you get all of the above plus digital data storage—it's a video disc and floppy disc in one, for creating training programs of unparalleled sophistication.

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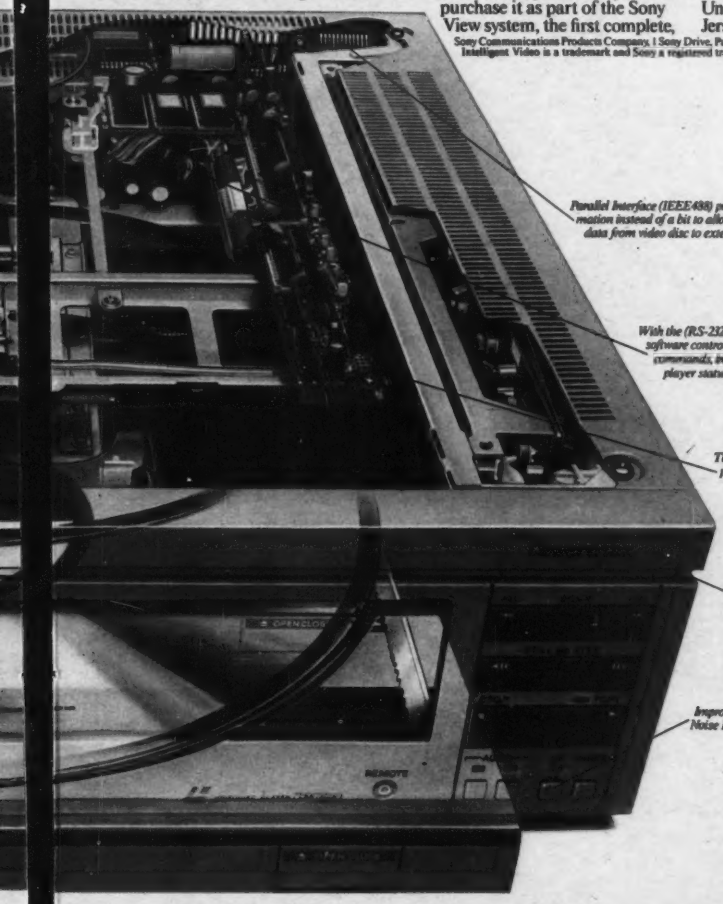
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SONY. Video Communications

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Continued from page 66

tion with Microsoft Corp.'s Windows operating environment.

Inavision reportedly features optional mouse capability, allowing users to choose drawing and editing functions from pull-down menus with a mouse. The software incorporates the Windows capability for simultaneous viewing of multiple screens. Multitasking allows users to edit multiple documents or draw while printing hard copies.

Inavision includes zoom capability for close-up or faraway viewing of the design. Other CAD functions include rotation and scaling.

The software requires a minimum of 320K bytes of memory.

Inavision is priced at $495.

Micrografx, 1820 N. Greenville Ave., Richardson, Texas 75081.

■ **Analytics Communications Systems, Inc. has announced a Data Encryption Standard security package for the IBM Personal Computer line.**

Sherlock Personal Computer Security Module's security features reportedly include encryption and decryption of local files, secure local signon, key management, verification of communicated messages and approval for program change controls.

The package is available in two models: an asynchronous version that does not require an adapter and a bus-level peripheral.

The bus-level model sells for $1,065, and the asynchronous version costs $1,150.

Analytics Communications Systems, 1820 Michael Faraday Drive, Reston, Va. 22090.

■ **Ozz Networking Systems has introduced Ozzpoint/Management System, a sales support data base program for use with the IBM Personal Computer and machines under Datapoint Corp.'s DOS or Resource Management System.**

The software reportedly permits the sorting of the data base by Zip codes and includes statistical analysis capability for use in measuring the effectiveness of advertising campaigns.

Ozzpoint/Management System is priced at $89.95, according to the vendor.

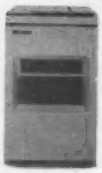
Ozz Networking Systems, Suite 216, 6309 N. O'Connor Road, Irving, Texas 75039.



Ethernet



8010 Star Workstation



8044 Print Server



8073 Communications Server/8032 File Server

Matt's office has been winning a lot of new business lately. And it's really not much of a secret.

Because he and his co-workers have been able to make more efficient use of their resources. How? Well, Matt brought in Team Xerox.

Which includes Xerox 8010 Star

"I heard you underbid us by half a million. What's your secret?"

XEROX

Workstations, high speed laser printers, file servers for organizing and storing data and communications servers for accessing mainframe data bases, all linked together with a Xerox Communications Network. For complex analytical tasks, Xerox also included a Xerox Artificial Intelligence System.

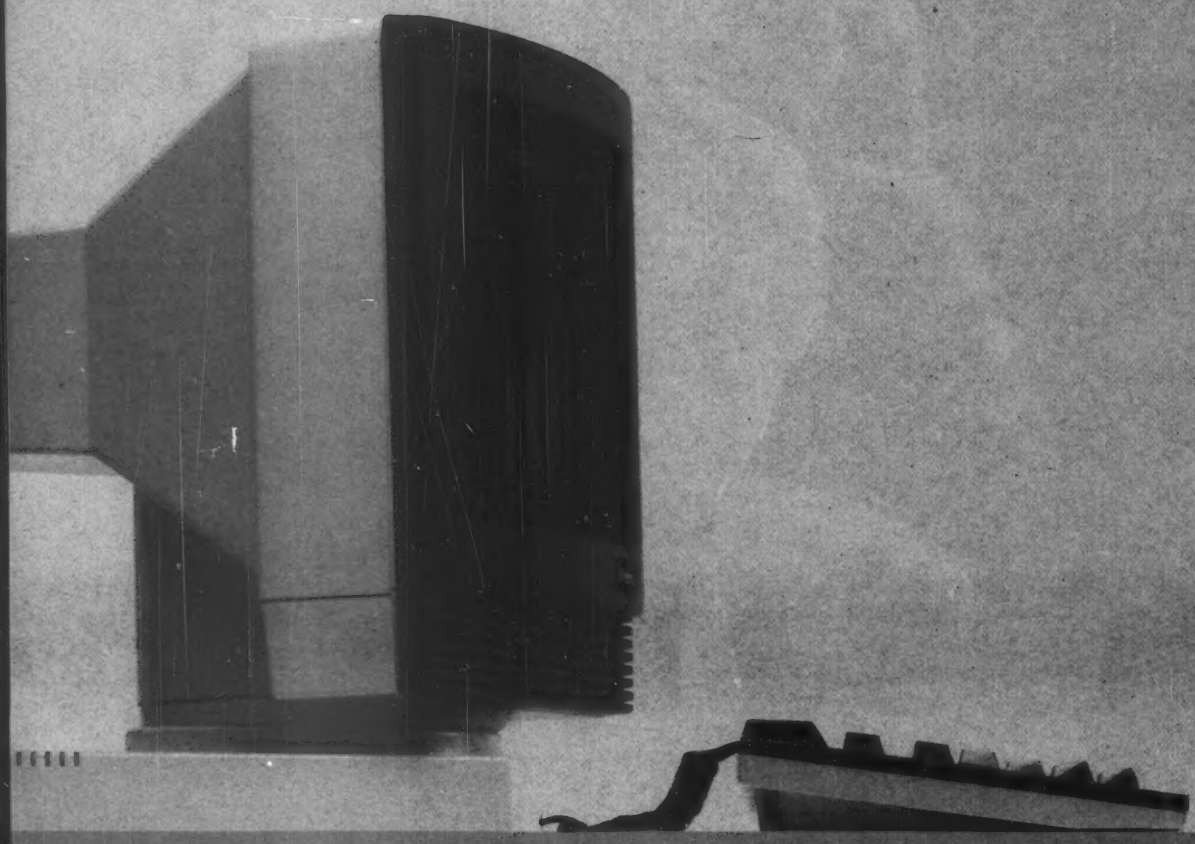
So Matt (and the people in his domestic and international offices) could create, access, share and react to information more quickly and more easily than ever before.

And since Matt's office has become so much more productive, he was able to cut costs—and enter a bid that was $500,000 less than anyone else's.

To make Matt's secret yours, call Team Xerox at 1-800-833-2323, ext. 42 or send your business card to Xerox Corp., Dept. 42013, P.O. Box 24, Rochester, NY 14292.



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What's more, this is the first TeleVideo® terminal to be warranteed for one full year.

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COMMUNICATIONS

Net control offers opportunity



WIRE TAP
Paul Korzeniowski
CW Senior Writer

How does one spell opportunity? How about N-E-T-W-O-R-K-M-A-N-A-G-E-M-E-N-T?

The divestiture of AT&T and the growing importance of networks to businesses, large and small, have created a number of opportunities for corporations, individuals and vendors.

Corporations have the opportunity to reign in network control, which in many cases is running wild. Before divestiture, AT&T was responsible for locating glitches in a communications line. On Jan. 1, 1984, responsibility for a line became clouded as AT&T and its former operating companies began finger pointing rather than troubleshooting. Call one firm with a problem, and it will point to another as the source.

The easiest way for a corporation to stop this nonsense is by performing its own network management. Beside enabling network operators to right some problems themselves, the packages help pinpoint telephone company trouble spots, reducing the runaround.

When taking network management into their own hands, companies should carefully examine existing network designs. Divestiture, the growing number of personal computers accessing larger systems and technical advances may have rendered designs from a few years ago obsolete.

Some larger companies are starting all over again. McDonnell Douglas Corp. in St. Louis has replaced a Centrex and

See MANAGE page 72

DATA STREAM

Network supports IBM 3270

By John Dix
CW Staff

Although most local networks do not provide the flexibility and availability associated with wiring systems like IBM's Cabling System, some networks can be used as viable alternatives to hardwiring terminals.

Ungermann-Bass, Inc.'s recently announced ability to support IBM 3270-type traffic, for example, makes its Net/One local network much more attractive. Companies that already have Net/Ones installed can add 3270 support for roughly $1,000 per terminal, a price that includes the cost of supporting the controller.

That price is reasonable given the high cost — often several hundred dollars — of rewiring point-to-point coaxial cables each time 3270-type terminals and printers are moved.

This Ungermann-Bass capability is made possible with two new interfaces, the Network Interface Unit Model 74 (NIU-74) and Network Interface Unit Model 78 (NIU-78). These units reportedly work with both the baseband and broadband implementations of Net/One

See NET/ONE page 72

Globenet enters pact with SBN

By John Dix
CW Staff

CHICAGO — Satellite Broadcast Network, Inc. (SBN) and Globenet have entered a joint marketing agreement to push a hybrid, two-way communications system that links SBN's satellite data transmission capability with Globenet's packet-switching network.

The digital service combines a point-to-multipoint, host-to-workstation satellite connection with a return terminal-to-host packet net connection. It is intended for companies that need to transmit the bulk of their traffic outbound, as in data distribution or the updating of remote data bases, and is said to cost half that of AT&T multidrop lines.

SBN is a 3-year-old company that markets a demodulator enabling consumers who have C-band receive-only satellite antennae to tap the company's Agribusiness or general business data bases. Both data bases are procured by SBN from Agridata Resources, Inc., a firm that specializes in agricultural news, market data and other information such as major U.S. Department of Agriculture reports, according to Frank Yurasek, vice-president of marketing.

Globenet was incorporated 1½ years ago to resell the packet-switching services of GTE Telenet Communications Corp., Tymnet, Inc. and Uninet, Inc. According to Jacob Kuykendall, Globenet chief executive officer and president, having access to all three carriers enables Globenet to pick and choose the lowest costs and use the networks to back up each other.

As a reseller, Globenet can combine carrier facilities to realize savings, whereas

See HYBRID page 74

- Gandalf Data, Inc. has announced a software package that enables its Pacx 2000 family of data switches to be networked **74**
- Automatic dialing equipment and software for the IBM System/34, 36 and 38 minicomputers debuted from Orion Software, Inc./**74**
- Complex Systems, Inc. annouced a time division multiplexer that works with either the 56K bit/sec. Digital Dataphone Service or private lines/**74**

INSIDE

Voice/Data Communications/**74**
Software/**74**
Multiplexers/Modems/**74**

Sytek system allows operators to monitor broadband activity

MOUNTAIN VIEW, Calif. — Sytek, Inc. has introduced a network management system that enables operators to monitor activity on moderate to large implementations of the firm's broadband local-area nets.

The Sytek 5101 Network Control Center, an upwardly compatible replacement for the Sytek 50/100 NCC, enables managers of the company's Localnet products to set parameters such as transmission speed and parity for each remote network device. The system is menu driven and can work with two to 1,000 devices.

Two optional software capabilities include the digital monitor option, which provides the means to collect data from up to five Sytek Statistical Monitors — used to gather information from the network — and sends the data to a hard disk or a printer port for analysis and report generation; and the queue server option, which queues users when network resources are busy.

The Sytek 5101 Network Control Center is based on an NCR Corp. Tower supermicro that uses a Motorola, Inc. 68010 microprocessor and AT&T's Unix System V operating system. A base unit includes 1M byte of random-access memory (RAM), a 46M-byte hard disk drive, 5¼-in. floppy disk drive with a 1M-byte capacity and a cartridge tape drive that can store 45M bytes of data.

In the event of a power failure, data is automatically stored in battery-supported RAM for up to four hours. The processing unit automatically restarts upon power restoration. The product's central call routing facility enables a user to be connected to a proper device automatically or by an operator.

An eight-port model sells for $28,950, and a 16-port device costs $31,750. The digital monitor option retails for $1,600, and the queue server option is priced at $2,500.

Sytek is located at 1225 Charleston Road, Mountain View, Calif. 94039.

Sun Microsystems unleashes gateway, software, connector

MOUNTAIN VIEW, Calif. — Sun Microsystems, Inc. has announced communications products that connect Sun workstations to IBM mainframes and compatibles and enable Ethernet local nets to be linked over wide areas.

The Sunlink SNA 3270 is a gateway that enables Sun workstations on an Ethernet network to access IBM Systems Network Architecture (SNA) hosts.

The gateway supports up to 24 simultaneous sessions that can be dynamically allocated.

The product's windowing capability reportedly enables users to create a number of SNA windows and to run numerous sessions concurrently. With a mouse, users can switch between SNA and AT&T Unix applications, the company reported. Users can view data, capture the data to disk or print it anywhere on a Sun Ethernet using IBM 3287 printer emulation.

Sunlink Binary Synchronous Communications (BSC) RJE software is said to provide a bridge between Sun workstations and IBM RJE systems. A user can exchange files and execute remote programs with systems that use IBM's 2780, 3780 or Hasp protocols, according to the company.

Sunlink's Internetwork Router can be used to connect two or more Ethernet networks by lease line, dial-up or satellite connections. The Internetwork Router supports data rates up to 9.6K bit/sec. by itself; when supplemented with Sun's Sunlink Communication Processor, an optional board for the gateway processor, speeds up to 64K bit/sec. are possible, according to the vendor.

Sunlink SNA 3270 costs $2,000, Sunlink BSC RJE software sells for $1,500, and Sunlink Internetwork Router is priced at $2,000, the vendor said.

For additional information, Sun Microsystems is headquarterd at 2550 Garcia Ave., Mountain View, Calif. 94043.

NET/ONE from page 71

over any media. The system supports IBM's Systems Network Architecture (SNA) and Binary Synchronous Communications protocols.

IBM 3274 controllers are attached to a Net/One by wiring directly to a 16-port NIU-74. Eight-port terminal network interface units can be located anywhere on the network and support, through direct coaxial cable connections, IBM 3178, 3278, 3179, 3279, 3180, ITT Courier 1178 and Telex 078 display terminals.

Additionally, NIU-78s support the IBM 3270 Personal Computer in control unit terminal mode and personal computers when outfitted with the IBM Personal Computer 3278/3279 Emulation Adapter, Digital Communications Associates, Inc.'s Irma board or Forte Communications, Inc.'s Forte board.

The NIU-74s and NIU-78s are designed to support the 2.3M bit/sec. speeds associated with IBM's Type A coaxial-cable-attached 3270 devices. Because, however, both Net/One implementations use the carrier-sense multiple access method, network loading is critical to net performance and terminal response time.

Ungermann-Bass calculated the maximum number of devices that could be supported based on desired performance criteria, according to product manager Charles Feltman.

One such consideration was the permissible lag time between when a character was struck on the keyboard and when it appeared on the screen. The NIU-74's and NIU-78's response time was designed never to let the screen fall more than two characters behind the struck character, which is as good or better than IBM's response time, Feltman said.

Based on response time parameters, baseband implementations of Net/One, loaded to no more than 80% of capacity, can support 2,700 devices per net segment. Broadband implementations, loaded to a maximum of 50% capacity, can support 820 devices per channel, or a total of 4,100 devices on the network's five channels. The broadband version operates at 5M bit/sec. while all other implementations operate at 10M bit/sec. These figures presuppose that the 3270 devices are the only ones on the network. Users who already have partially loaded networks will not be able to support as many devices.

To support more terminal devices, networks can be bridged or, in the case of baseband versions, net segments can be interconnected with repeaters. With broadband implementations, the terminals or printers that are supported can be up to five cable miles away from the controller.

Both the local and remote versions of IBM's 3274 controllers are supported. But, more important, because terminals can be located so far from CPUs, users can pull remote controllers back to the machine room and locally attach them, thus vastly improving terminal response time.

Any peripheral device supported on a NIU-78 can access any NIU-74 port on the network. The system also reportedly offers a port rotoring capability that enables terminals to contend for controller ports. This is said to reduce the number of required controllers because terminal users can queue for ports.

Obviously, companies that don't have Net/Ones installed will be less inclined to purchase the system just to support IBM terminal gear. IBM's Cabling System provides greater availability — a data outlet in every office — and will be used as the foundation for the company's forthcoming token local-area network. For users with Net/Ones installed, the NIU-74 and NIU-78s do, however, provide workable options to hardwiring IBM terminals.

MANAGE from page 72

satellite communications system with a $58 million network driven by private branch exchanges. Electronic Data Systems Corp. has begun designing a $350 million network for its owner, General Motors Corp.

These sophisticated networks offer an opportunity to cut network costs. By carefully examining requirements and choosing suitable equipment, companies can increase the proverbial bang for the buck. McDonnell Douglas estimated that its network would save the company $15 million per year.

Senior management tends to notice such savings. MIS managers who save a company such large amounts of money are often rewarded financially and with career opportunities.

Network management can also present opportunities to network operators, who are becoming some of the most highly sought after data processing professionals. Network management staffs could mushroom just as microcomputer support centers did a few years ago.

Vendors are presented with an opportunity to turn a healthy profit. Corporations seem ready to invest in these packages but are not sure which system is best. For a few reasons, no network management package dominates the current market.

A great deal of flexibility exists in the manner in which a package could monitor transmissions. Certain firms have looked only to protect their existing markets and not to tap other markets, so their packages work well with only their equipment.

A more serious problem is that none of the systems provide comprehensive evaluation tools. Some are very good at monitoring the data that goes over the lines; others work well evaluating network connections. There doesn't seem to be one package that does both well. Such a package could do for network management what Lotus Development Corp.'s 1-2-3 did for personal computers.



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COMPUTERWORLD

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users that want to gateway one net to another will still pay the initial carrier's charges, Kuykendall said.

Combining one-way satellite distribution services with terrestrial packet nets gives the best of both worlds, Kuykendall said. Use of satellites for the heavy host-to-terminal traffic obviates the time and kilocharacter charges associated with packet nets, and the terminal-to-host packet return link enables the service to use error detection and retransmission. Unlike forward error checking, used with some one-way satellite services, this method provides more efficient use of the satellite resources and enables what Kuykendall called virtually error-free transmission — error rates in the 10 to the negative eighth range.

In practice, an insurance company, for example, would tie its headquarters to an SBN earth station with a private line. That facility will broadcast the traffic — via the Ku-band Hughes Galaxy One satellite — at 9.6K bit/sec. to all branch offices, which are outfitted with 1m to 1.2m receive-only antennae.

The antennae are part of a hybrid station management module that is an intelligent device providing error detection. It wakes up upon recognition of its address, autodials a packet net and logs itself on, establishing a return connection to the master earth station. The 1,200 bit/sec. packet link is used for retransmission and other transaction requests.

SBN will strategically locate master earth stations around the country.

Service prices include fixed hardware costs, recurring monthly charges and usage-sensitive rate elements.

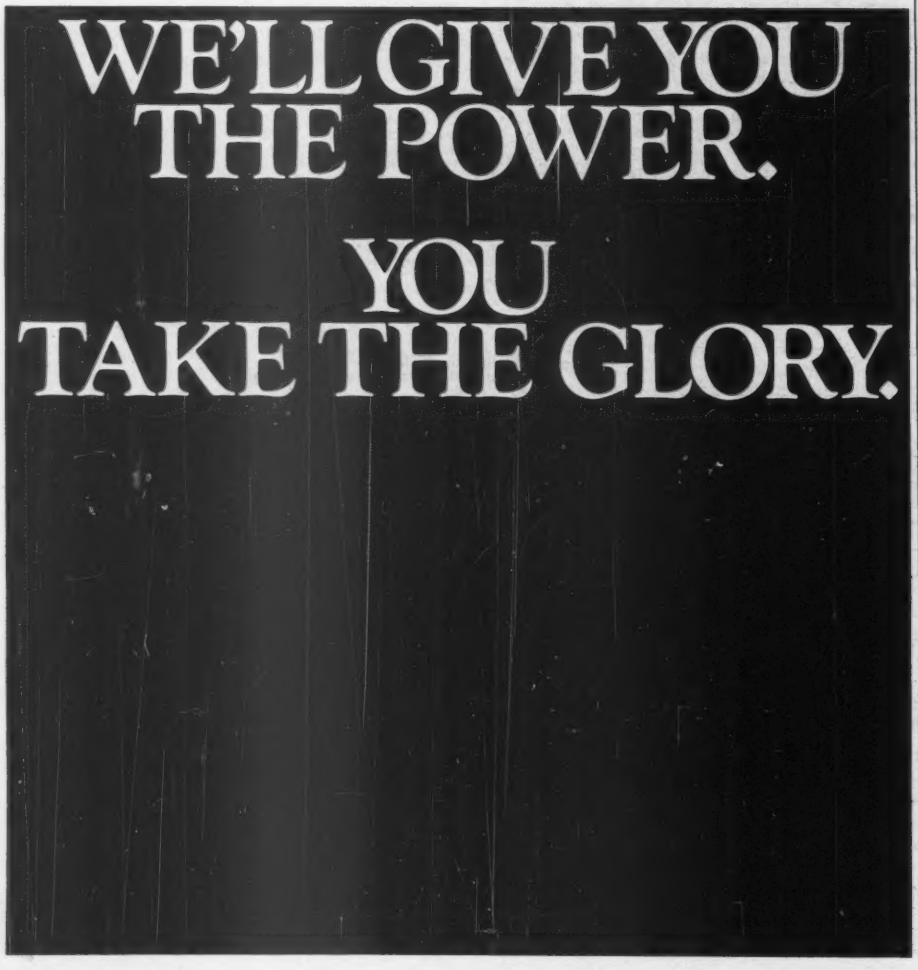
On the host side, users can pick up the tab for installing their own master earth station or shoulder a roughly $20,000 charge for shared use of a master facility. The remote hybrid station management modules, which include the antennae, cost roughly $3,500.

Other charges include a $5,000/mo space segment fee for each full time, 24 hour/day, seven day/week 9.6K bit/sec. channel; and packet net charges that vary with use.

Kuykendall said the service is scheduled to be available in late September or early October.

SBN is located at 212 W. Superior St., Chicago, Ill. 60610. Globenet is located at Suite A 1715, 175 W. Jackson Blvd., Chicago, Ill. 60604.

Not long ago, *PC* Magazine called MDBS III "The most complete and flexible data base management system available for microcomputers." That's a powerful statement. But then, MDBS III is an amazingly powerful software package. So powerful, in fact, that it lets you build mainframe-quality application systems on your micro or mini. MDBS III is not for beginners. It's for application developers with large data bases or complex data interrelationships who want to define data base structures in the most natural way—without resorting to redundancy or artificial constructs. It's for professionals who can appreciate its extensive data security and integrity features, transaction logging, ad hoc query and report writing capability and its ability to serve multiple simultaneous users. And if you want the power and the glory that only the world's most advanced data management system can provide, MDBS III is for you. For information on MDBS III and our professional consulting services, write or call Micro Data Base Systems, Inc., MDBS/Application Development Products, 85 West Algonquin Road, Suite 400, Arlington Heights, IL 60005. (800) 323-3629, or (312) 981-9200. **MDBS III. ABSOLUTE POWER.**



VOICE/DATA COMMUNICATIONS

■ Gandalf Data, Inc. has announced a network software package for its Pacx 2000 family of private branch exchanges.

The software enables two to 32 data switches to be used as switching nodes in a network that supports up to 20,000 users. The software adds eight levels of security that limit unauthorized use of network resources. A network can reportedly be configured so various users are restricted from accessing specific devices.

Whenever a network map has been programmed into one node, it can be downloaded to other nodes in a system. If a route is not available, the system will automatically route it through an available device.

The software costs $1,000.

Gandalf Data, 1020 S. Noel, Wheeling, Ill. 60090.

SOFTWARE

■ Orion Software, Inc. has announced automatic dialing equipment and software for the IBM System/34, 36 and 38 minicomputers.

Auto Call Equipment (ACE) reportedly doubles the number of connections per host by using a single port for both data and autodialing. It requires a system that accommodates a bisynchronous protocol, including most IBM minis running Synchronous Data Link Control and the Nokia-Kinex Corp. 208AB or 201C modem or compatibles.

ACE supports Orion's ACE/3X software and Network Orion electronic mail system. ACE/3X is a utility program that allows users to issue programmed calls in an ACE-compatible format. It also enables ACE to return to the user program status codes in the event of call failure.

ACE is priced at $1,295 and ACE/3X software costs $625.

Orion Software, 222 Third St., Cambridge, Mass. 02142.

MULTIPLEXERS/MODEMS

■ Complex Systems, Inc. has announced a time-division multiplexer that works with 56K bit/sec. Digital Dataphone Service or private lines.

TDM 56, a synchronous multiplexer, has six ports that support data at speeds from 2,400 to 19.2K bit/sec. The ports can be configured in eight ways, two examples being five 9.6K bit/sec. ports and one 4.8K bit/sec. port or two 19.2K bit/sec. ports, two 9.6K bit/sec. ports and two 2,400 bit/sec. ports.

A user can select speeds and set up parameters by using a front-panel display. Configuration changes at one end of a link will be automatically made on the other end. Parameters are stored in nonvolatile random-access memory.

The product transmits EIA signals for support of tail circuits and end-to-end signaling. Local and remote loopback tests can be made for each channel and initiated either locally or remotely.

TDM 56K costs $1,395.

Complex Systems, 4930 Research Drive, Huntsville, Ala. 35805.

SYSTEMS & PERIPHERALS

Prime to market plotters

NATICK, Mass. — Prime Computer, Inc. has announced that it will market three California Computer Products, Inc. plotters as enhancements to its line of computer-aided design and manufacturing workstations and terminals. The company also enhanced its PW150 graphics terminal.

The Calcomp plotters are integrated with Prime's Medusa two- and three-dimensional solid modeling software; Crown Software Systems, Inc.'s Sammie human factors 3-D interactive software system; and Ford Motor Co.'s Product Design Graphic System CAD system for curved body surfaces.

The Calcomp Model 1044 is a low-end plotter with eight pens and cut sheet and continuous roll plotting. The unit costs $13,800.

The four-pen Calcomp Model 1077 also allows for cut sheet and continuous roll plotting. It costs $29,900. The top-of-the-line Model 5744 is an electrostatic plotter capable of displaying 400 dot/in. plotting density. It costs $69,500.

Prime also announced its PW153 graphics terminal, an enhanced version of its PW150 graphics terminal. Added features include shaded viewing and an increase from four to 16 colors. The PW153 costs $18,750 singly, with additional terminals costing $15,000.

Prime is located in Prime Park, Natick, Mass. 01760.

Design system offers VAX link

ANAHEIM, Calif. — California Computer Products, Inc. has released an AT&T Unix-based computer-aided design system said to meet the design and drafting requirements of the architectural, engineering and construction markets. The distributed processing system can be connected directly to Digital Equipment Corp. VAX series computers.

The System 25 has a 32-bit applications processing unit and a picture processor that uses a series of separate microprocessors to perform all display processing.

Capabilities include Ethernet local-area networking ability and Multibus interface technology. A basic System 25 includes two displays, a 12-in. monitor and a graphics screen. Also included is a keyboard, a joystick, a digitizer table and stylus, a 20M-byte disk drive and a 1M-byte floppy-disk unit for data backup. The basic system costs $65,000.

Calcomp is located at 2411 W. La Palma Ave., Anaheim, Calif. 92801.

Wang desktop laser printer out

LOWELL, Mass. — Wang Laboratories, Inc. has released a desktop laser printer for its VS systems and Office Information System machines.

The LPS8 is said to provide letter-quality output at up to 8 page/min. It supports multiple font styles on a single page and can print on transparencies and 3- by 5-in. cards.

The desktop laser printer offers both landscape and portrait options for each of the 99 font styles it supports, according to the vendor.

The recommended duty cycle for the LPS8 is 150 page/day or 3,000 page/mo.

The unit costs $5,000.

Standard, signature and customized fonts cost $99; logo fonts cost $199, Wang said.

For additional information, Wang is located at One Industrial Ave., Lowell, Mass. 01851.

Graphics terminals introduced

ACTON, Mass. — CGX Corp. has released a pair of graphics workstations with IBM 5080 compatibility and local three-dimensional capabilities.

The 2033 and 2023 workstations use color raster and vector display technologies, respectively.

The workstations were designed to be used in IBM host-based computer-aided design and manufacturing installations, the vendor said.

The 2033 and 2023 reportedly support Cadam, Inc.'s Cadam and ICP; Dassault Systems' Catia; Structural Dynamics Research Corp.'s Caeds; Bell Northern Research Ltd.'s CBDS; Northrup Corp.'s Ncad; Mathematical Applications Group, Inc.'s Synthavision; and General Motors Corp.'s CGS CAD/CAM software packages running on IBM 370, 4300 and 30 series mainframes.

Features on the 2033 raster and 2023 vector workstations include a local 3-D graphics processor, valuator dials for manipulation of 3-D images and an interface to large-screen projection systems. The 2033 has additional features such as color hard-copy interface and selective pick windowing and visual overlay detection hardware.

The 2023 has 128K bytes of system memory, expandable to 1.1M bytes. The 2033 has 640K bytes of system memory, expandable to 1.1M bytes. Up to 16 workstations can be linked via a CGX 2010 channel unit that monitors the integrity of the system and provides an interface to the IBM mainframe.

The list price of a 2033 color raster workstation is $33,800; the 2023 vector workstation costs $29,700. The 2010 channel unit costs $14,500. Two-dimensional versions of the 2023 and 2033 cost $24,000 $24,500, respectively.

More information can be obtained from CGX at 43 Nagog Park, Acton, Mass. 01720.

- Pericom, Inc. added two graphics terminals that are compatible with DEC and Tektronix, Inc. terminals/**76**
- Raster Technologies enhanced its Model One/380 graphics system/**76**
- CDC will begin marketing Digicon Geophysical Corp. seismic software for use on specially configured CDC Cyber 180 mainframes/**80**

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Parallel processing — An old idea with new uses, limits



HARD TALK
Tom Henkel
CW Senior Editor

Parallel processing systems seem to be the hot items of the summer. Encore Computer Corp. was touting its Multimax system, based on multiple National Semiconductor Corp. 32032 microprocessors, at last month's National Computer Conference; Intel Corp. just announced the first five recipients of its IPSC concurrent parallel machine; and two weeks ago, Perkin-Elmer Corp. added a mid-range parallel system to its product line with the promise of additional parallel systems in the next few weeks.

Why the sudden flood of parallel machines? Well, the flood really is not all that sudden. The ideas incorporated in parallel processing have been around for years. For example, PE noted it has essentially been in the parallel processing business for about 10 years, pointing to its 7/32 and 8/32 shared memory systems introduced in 1975.

So why are more vendors jumping on the parallel processing bandwagon lately? For one thing, the market for powerful, scientific processing systems seems to be the only bright spot in an otherwise gloomy year for computer vendors.

For a long time, scientific users have been moaning that they needed systems that would allow them to break up complex problems into smaller, more easily manageable pieces for processing. This sort of processing has worked well on multimillion-dollar supercomputers but has been cumbersome on traditional von Neumann architecture processing systems. Now, some clever systems designers have figured a way to develop processors with supercomputer-like qualities which, albeit slower than the Cray Research, Inc. Cray XMP, have a more palatable price tag — in the traditional superminicomputer range.

Economics is another advantage for the parallel machines. It is much less expensive to tie multiple small systems together in such a way that the combined processor complex offers an impressive throughput than it is to develop a powerful uniprocessor to do the same work. The economic advantages become even sweeter when the CPUs connected in a parallel architecture have been around for a while and computer vendors have been able to recoup much of their original R&D costs by selling them as uniprocessors. In fact, one of the big advantages of the Encore and Intel hypercube approach is they use off-the-shelf microprocessor technology. PE too is capitalizing on existing processors in its product lineup. The firm's top-end 3260MPS configuration was based on an existing PE processor, the 3250. Likewise, the company's newest parallel configuration, the 3232MPS, was designed around the 3230MPS.

If the latest round of parallel processors are faster, cheaper and easier to build than their uniprocessor counterparts, the new wave of machines sounds like the perfect deal. But the deal may contain some obstacles. Users switching from a uni-

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SYSTEMS & PERIPHERALS

DATA STORAGE

■ System Industries, Inc. has announced a quick-disconnect feature that has been incorporated into its 9722 and 9733 Winchester storage systems for all Digital Equipment Corp. computers, all Data General Corp. systems and the Hewlett-Packard Co. HP 3000.

The quick-disconnect housing — for users who need secure sites but wish to use Winchester-type disks — contains the head disk assembly in a slide mount adaptation with a nonremoveable power supply permanently located to one side. One drive can be placed into each of these housings. An operating lever pops the head disk assembly forward so it can be grasped by its carrying handles and removed. A magnetic plunger automatically locks the head disk assembly in place when the drive is powered down and removed.

The quick-disconnect option adds $2,100 to the cost of the drive. The 9722 storage system costs $8,100, and the 9733 costs $11,000.

System Industries, 1855 Barber Lane, Milpitas, Calif. 95035.

TERMINALS

■ Pericom, Inc. has added two graphics terminals and a screen printer to its product line.

The company's MG-600, a monochrome terminal, includes 1,024- by 780-pixel resolution and in graphics mode is compatible with Digital Equipment Corp.'s VT220 and Tektronix, Inc.'s 4014 terminals. Other features are a 15-in. tilt-and-swivel antiglare monitor, support for a mouse or a digitized tablet, block-mode transmission, short persistence phosphor and support for multiple hosts.

The MD-420 is similar to the MG-600 but uses a 20-in. monitor.

By pressing a button, the Monterey Video Printer prints a screen of data in 12 seconds. The product supplies a resolution of 160 dot/in.

The MG-600 sells for $2,895, the MG-420 is priced at $4,995, and the Monterey Video Printer costs $3,395.

Pericom, Suite 100, 51 Digital Drive, Novato, Calif. 94947.

■ Westward Technology, Inc. has introduced its Model 2215 desktop monochrome graphics terminal.

The 15-in. terminal features 1024- by 784-pixel resolution, 57Hz noninterlaced flicker-free screen and an Ascii character set.

The Model 2215 costs $3,995.

Westward Technology, 90 Montvale Ave., Stoneham, Mass. 02180.

PRINTERS/ PLOTTERS

■ Imagen Corp. has released its Imagestation series of text and graphics laser printers for workstations that run the AT&T Unix operating system, including those of Digital Equipment Corp., Sun Microsystems, Inc. and Apollo Computer, Inc.

All Imagestation models include emulators for the Epson America, Inc. FX-80, the Diablo Systems, Inc. 630 ECS, the Qume Corp. Sprint 11, the IBM 5152 and the Tektronix, Inc. 4014 printers. The printers have a resolution of 90,000 dot/sq. in. and use dry toner and plain paper. The printers support a variety of document composition systems.

The Executive, intended for text and business graphics, costs $5,950. The Designer — for graphics support — is priced at $6,400. The Innovator, which costs $7,200, was designed for demanding graphics, including computer-aided design and engineering applications.

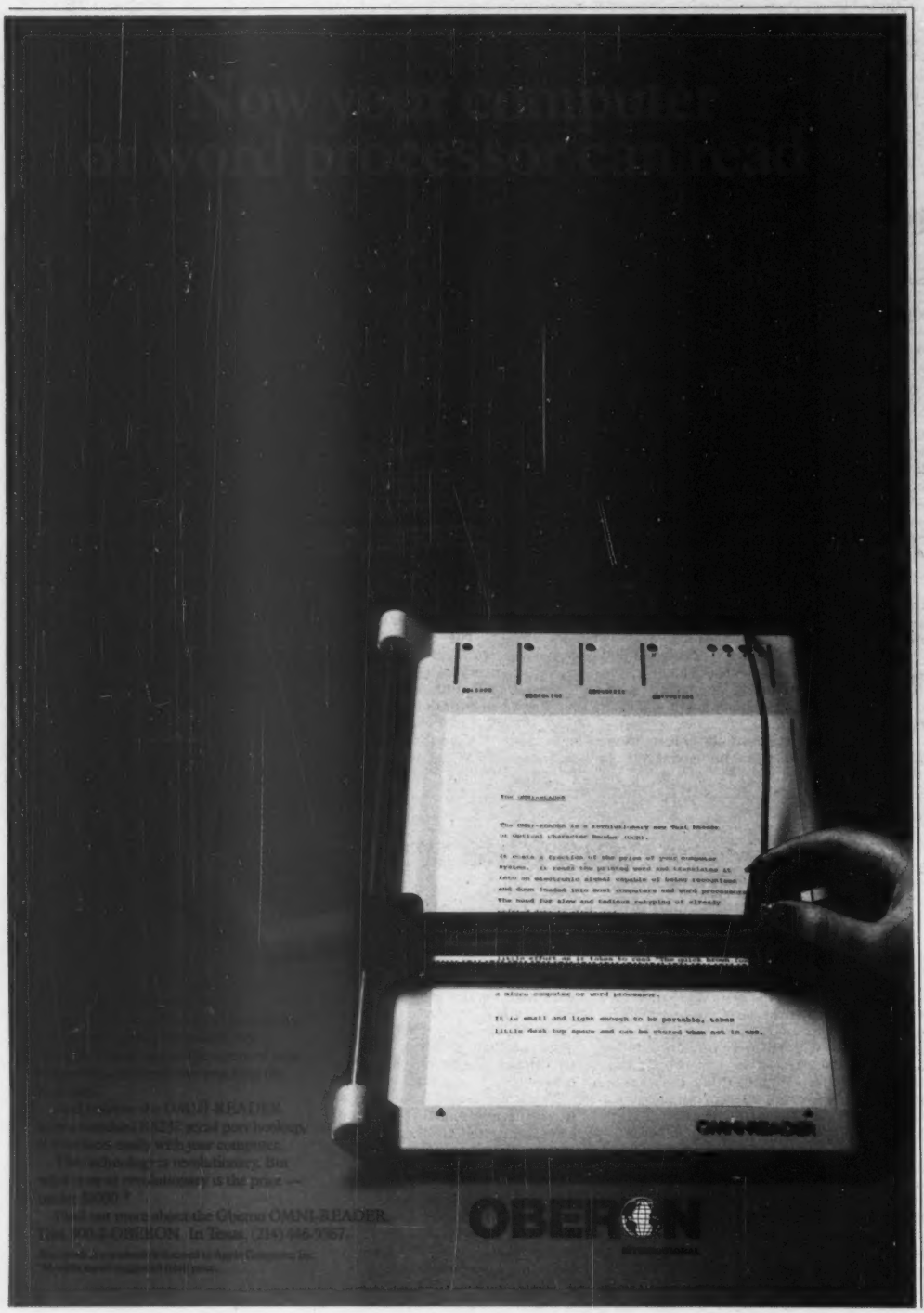
Imagen, 2674 N. First St., San Jose, Calif. 95134.

GRAPHICS SYSTEMS

■ Raster Technologies, Inc. has announced an enhancement to its Model One/380 computer graphics system.

The enhanced 64-bit Model One/380 three-dimensional system is said to provide an integrated rendering pipeline that brings 3-D visualization into a real-time mode. It will provide 64-bit planes of image memory that allow for 24-bit double-buffered true

Continued on page 80



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SYSTEMS & PERIPHERALS

Continued from page 76

color display with 16 bits of depth buffering.

The Model One/380 is available in a desk-side tower enclosure with a 19-in. 60Hz monitor and keyboard. Prices start at $41,500.

Raster Technologies, 9 Executive Park Drive, N. Billerica, Mass. 01862.

POWER SUPPLIES

■ American Power Conversion Corp. has announced the Model 750RM uninterruptible power source for multiuser processors, computer-aided design and manufacturing systems and communications systems.

The 750RM provides up to 600W or 750VA of low-distortion power to ac loads of any power factor or wave form. During an extended outage a typical load of 60% can be powered for more than 40 minutes. At full load, the operating time is more than 20 minutes.

The 750RM provides protection from irregularities that account for more than 87% of all power-related problems. The 750RM protects against brownouts, under- and overvoltage, surges, spikes and conducted interference.

Additional features of the 750RM include fully automatic operation, phase-synchronized transfers, low distortion, 90db audible alarm, internal self test at turn on and overtemperature protection.

The 750RM weighs 70lb with battery and is priced at $3,000.

American Power Conversion, 89 Cambridge St., Burlington, Mass. 01803.

■ Ulveco, Inc. has announced SIS 9310 system, an uninterruptible power supply featuring fault-tolerant parallel redundant power distribution.

The SIS 9310 system delivers 640W with three redundant supplies of 320W each. The device is mounted in a box measuring 19 in. wide by 16.2 in. deep by 8.7 in. high, configured for mounting in a standard 19-in. rack cabinet. The system can deliver 320W with full redundancy using two modules, the vendor said.

Supervision and control circuitry for load management and current sharing is repeated in each power supply module. One module automatically assumes the master role. Should it fail, another module automatically takes over. Each module is independent and may be removed from the cabinet and replaced without disturbing the load.

The SIS 9310 system is available in the U.S., Japan, Europe and the UK. The product is aimed at voice/data communications appplications, as well as broadcasting and civilian and military ground stations for communications and satellite links.

The SIS 9310 system costs $1,800 to $2,500 for a three-module system.

Ulveco, 323 Vintage Park Drive, Foster City, Calif. 94404.

CDC, Digicon ink marketing pact

HOUSTON — Control Data Corp. of Minneapolis and Digicon Geophysical Corp. here have signed a three-year value-added remarketing agreement whereby Digicon will enhance its Disco seismic software for use on CDC's specially configured Cyber 180 seismic processing system.

The Disco software is used by oil companies, geophysical contractors and universities, according to a spokesman.

Current configurations of the CDC seismic systems are said to have 4T bytes of virtual address space, up to 128M bytes of real memory and variable page sizes from 512 bytes to 65K bytes.

Additional information can be obtained from Digicom at Suite 112, 3701 Kirby Drive, Houston, Texas 77098.

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processor to a parallel processor will probably run into some conversion problems because the two systems architectures — even if they are designed around the same operating system, that is, AT&T Unix — are not necessarily compatible. Users can look forward to the possibility of making alterations to applications designed for a uniprocessor to accommodate the parallel processing environment.

Many users will also have to learn to look at program development from a whole new angle.

Number of efficiently functioning units

Then there is the question of how many processors can efficiently function in parallel configurations. Most companies marketing parallel systems will boast of theoretical maximum configurations in excess of 100 processors. In some applications 100 processors may be able to work efficiently.

However in others, some experts said there could be memory contention problems. These problems would render some CPUs in the parallel configuration helpless while waiting for other CPUs to free needed memory.

Most industry experts agree parallel processing will play an important role in the marketplace for the rest of the decade. But like anything else, parallel processing is not a cure-all. There are trade-offs that have to be made and skills that have to be learned to use the systems efficiently.



You could win $1000 in the first international computer-generated art contest

CW Communications, Inc. — the world's leading publisher of computer-related newspapers and magazines — is proud to announce its sponsorship of the very first international computer-generated art contest.

All entries must be computer-generated, mounted, and suitable for display. Entries will be judged primarily on their artistic merit, but execution will also be taken into account. Two prizes will be awarded. The winning individual will receive $1,000 (U.S.). The winning organization will receive a trophy.

Winners will be announced during the First Pan Pacific Computer Conference (in Melbourne, Australia, this September 10-13). All entries will be put on display in a special exhibit at this conference.



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FIRST PAN PACIFIC COMPUTER CONFERENCE / CW COMMUNICATIONS

COMPUTER INDUSTRY

Korean firm testing U.S. micro mart

By Clinton Wilder
CW Staff

A $10 billion South Korean conglomerate has decided to dip its toe into the turbulent waters of the U.S. business microcomputer market.

Although several Korean manufacturers have OEM agreements to assemble U.S. vendors' computers in their offshore plants, the Samsung Group is the first to sell its own systems in the U.S. — but it may not be the last.

"Office automation and information technologies have been identified as the hot area by the Korean government," said Merit Janow, a New York-based Asian development and marketing consultant and a senior fellow at the Hudson Institute, which conducts foreign economic policy research. "Korean companies are very concerned about protectionism and unlikely to declare that they're targeting the U.S., but it goes without saying."

Samsung, already a strong presence in U.S. consumer electronics and CRT computer monitors, used the recent National Computer Conference to launch its first U.S.-marketed business microcomputers through its Samsung Semiconductor & Telecommunications Co. (SST) division. But the company readily admits that its first foray into the U.S. computer market is an experiment.

No intention of making money

"We really don't know what the market will be like, but we decided to try these systems," said Kwang-Hoi Koo, manager of Samsung's computer export section. "We have no intention to make money on them. You could say we're using them to pay our tuition in the U.S. market."

The exported products are an IBM Personal Computer AT-compatible called, simply, the Samsung and the SSM-16, a multiuser supermicro based on the Motorola, Inc. 68000 chip and the AT&T Unix operating system. Samsung has sold the SSM-16 in Korea for two years. Koo said that a recent slowing of demand there prompted the company to expand its horizons — notwithstanding the U.S. micro shakeout. "Even in a downturn, the U.S. market is much better than the Korean," Koo said.

The Korean personal computer market was closed to imports in 1982 and 1983 as the government tried to protect its embryonic market. Significant OA growth potential exists in Korea, but even as the market slowly opens to foreign vendors, it is a tough nut to crack.

"You see businesses side by side, one with a local-area network and one with a mimeograph machine," Janow said. "There are tremendous imbalances. That's a major difference between Korea and Japan. The Japanese economies of scale were first developed to serve their domestic market, while Korea is very much an export-led economy."

Like several other Korean conglomer-

See TEST page 92

■ Datapoint last week said it agreed to a $22.5 million settlement to resolve class action stockholder litigation. The company did not admit to any wrongdoing, and the lion's share of the settlement will be paid by insurance companies/**86**

■ Computer Automation recently agreed to sell off its Commercial Systems division, explaining that it could not provide enough resources to the supplier of distributed data systems/**88**

■ Two top M&D executives recently jumped ship to take the top spots at a smaller company/**91**

Board decision seen boosting paper profits

STAMFORD, Conn. — In a long-awaited decision that is expected to boost paper profits for many software vendors, the Financial Accounting Standards Board (Fasb) recently announced it had resolved a 2½-year-old debate over recording software development costs.

Fasb said it has issued Statement 86, "Accounting for the Costs of Computer Software to be Sold, Leased or Otherwise Marketed." However, copies of the full document were not immediately released.

The statement, which is expected to be adopted by the Securities and Exchange Commission (SEC), mandates that software vendors record development costs as expenses in the year incurred until technological feasibility of the product is established, according to a Fasb spokeswoman.

The statement differs from an earlier draft proposal [CW, Sept. 17] in that it clarifies the point at which feasibility is established. According to the revised version, feasibility "is established on completion of a detailed program design or, in its absence, on completion of a working model of the product."

After such feasibility is determined, companies are mandated to capitalize all software production costs, enabling them to spread out the reporting costs over a number of years, thus increasing reported net profits for those companies with substantial production costs.

The earlier draft version would have allowed, in some cases, the capitalization of coding and testing performed prior to completion of a detailed program design or working model.

In hearings before Fasb [CW, May 13], the draft version drew opposing reactions from trade associations representing hardware and software vendors, both of which expressed dissatisfaction with the wording of the draft. The American Electronics Association advocated straight expense

See FASB page 91

Watershed time drawing near



INDUSTRY INSIGHT
Peter Bartolik
CW Senior Editor

Midway through the third calendar quarter, the major computer systems vendors should very soon have a handle on whether or not this year is going to go down as a watershed.

If the trend of the past two quarters continues or worsens, 1985 will not close on a happy note, reflecting at least a significant pause in the industry's breakneck growth pace.

With U.S. sales in a virtual no-growth holding pattern, most vendors have remained profitable from strong sales in Europe and other places. But the general consensus is that European sales tend to slack off in the summer. Also, there has been some early talk that the sales depression experienced over here may soon be duplicated over there.

IBM may be able to weather this quarter with its speeded up shipment schedule of 3090 mainframes and new disk drives, although there are a few skeptics among us who doubt that will be enough to erase the problems generated by slow mid-range systems sales.

Digital Equipment Corp. will probably experience its traditional fourth-quarter-to-first-quarter drop in revenue for the current reporting period, but the company claims it has costs under control. However, analysts have been saying the company has been too slow to cut manufacturing overhead, and a drop in international sales could be a problem.

See TREND page 91

AMD cost-cutting measures extended

SUNNYVALE, Calif. — Advanced Micro Devices, Inc. (AMD) announced last week it will extend its program of reduced pay for executive, managerial and professional personnel and reduced workweeks for other employees to the end of this year.

The semiconductor manufacturer indicated there is no prospect of business improving through the remainder of the year.

In a prepared statement, W. J. Sanders III, AMD's president and chief executive officer, said, "It is clear that market conditions are not improving, and no general upturn in demand this year can be expected.

"There can be no return to a full pay program until sales growth resumes or while losses are increasing," Sanders said.

The company adopted a widespread cost-cutting program June 13 that was scheduled to expire at the end of September.

The company said the extended program will be restructured to ensure equitable distribution of the burden among employees.

Thoughtware bids for DSS company

COCONUT GROVE, Fla. — Exemplifying the current trend of consolidation in the microcomputer software industry, Thoughtware, Inc. announced last week that it is negotiating to acquire Lightyear, Inc. of Santa Clara, Calif.

Thoughtware, a developer of decision support system (DSS), expert system and computer-based training software for the IBM Personal Computer series, offered an undisclosed amount of stock for Lightyear, which also produces DSS.

Thoughtware, based here, also announced that Terry Garnett, Lightyear's president and founder, will join Thoughtware's executive staff with responsibility for product marketing and development.

Lightyear had previously agreed to turn over to Thoughtware the distribution and marketing of its one product line, also called Lightyear.

Thoughtware's product line includes the Thoughtware Management Training Library, Trigger, The Advantage Series and Sell! Sell! Sell! software packages.

Restructuring on horizon in rapidly changing chip mart

OUTSIDE LINES
Bohdan O. Szuprowicz

One of the worst slumps in history has hit the computer and semiconductor industries. What is puzzling to many, however, is the fact that this downturn is taking place during a time when the overall economy is relatively healthy and certainly not in a recession.

Japanese competition, IBM aggressiveness, the strong dollar affecting U.S. exports, excess manufacturing capacity, overcrowding of suppliers, a confusing proliferation of new products, overinvestment in the early 1980s and inability to manage torrid growth rates are all being cited as contributing factors.

We would add to this litany a few other factors that are often left unmentioned by the industry and the trade media. During the last few years a number of research organizations made numerous overoptimistic forecasts of growth in many high-technology sectors. These were often used as bases for launching ventures and products without sufficient market analysis.

There is no question that all the above factors are in some degree responsible for the current plight of the semiconductor and computer industries, but we feel that a major restructuring of these industries is also under way. It is the result, in large measure, of the rapid development of the very large-scale integration (VLSI) microcircuit, increasingly powerful computer-aided engineering (CAE) tools to design and use such complex components and the portability of such advanced technologies.

All this is beginning to happen at a time when the semiconductor industry is undergoing its first VLSI crossover period, switching from the widely used 64K-bit random-access memory (RAM) memory chip to the more powerful 256K-bit RAM devices. The prices for the larger chips are declining even faster than the 35% annual decline experienced with previous memory chip generations.

But this is only part of the story because, while the Japanese already control 92% of the 256K-bit RAM market, U.S., European and Asian competitors are accelerating their programs to introduce 1M-bit RAM microchips. South Korea's Samsung Semiconductor Co., for example, is already advertising 1M-bit RAM products for 1986 delivery and Texas Instruments, Inc. is expected to beat AT&T by bringing out its 1M-bit RAM microchip six months earlier than originally planned. As a result, the 256K-bit RAM chip may end up with a life cycle of only one year instead of the usual four years for a new memory chip generation.

What this means is that a massive "Osborne Computer Corp. syndrome" is overwhelming the industry and end users are reluctant to upgrade their equipment knowing full well that much more powerful and cost-effective devices and systems are just around the corner. This also plays havoc with manufacturers who embarked upon upgrading their products based on 256K-bit RAM microchips only to realize suddenly that their competitors who plan to go directly to 1M-bit microchip-based products will clobber them in the marketplace before they even get a chance to recoup their investments.

It now appears that a short-lived VLSI redesign revolution is leading directly into ultra-large-scale integration (Ulsi), which promises microchips in the 1M-bit-and-over density category. The initial 1M-bit RAM market, projected to be worth a few million dollars in 1986, is expected to skyrocket to about $7 billion in 1992.

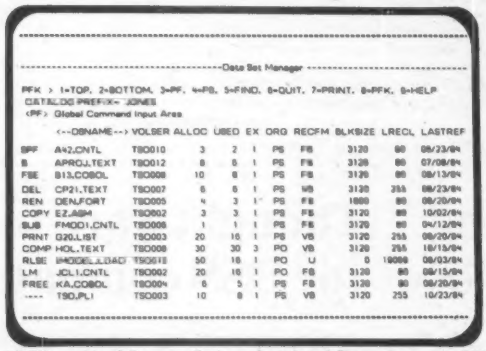
As competition intensifies, the 1M-bit RAM chip may be superseded by 4M-bit microchips by 1990, again earlier than originally expected. If that happens 16M-bit products would normally follow about four years later. However, given the enhanced CAE development tools based on the more powerful custom-designed microchips, these may come to market much sooner. Toshiba Ltd. of Japan made it known that it expects to be producing 64M-bit RAM chips by the year 2000 and Tokyo University researchers have already proposed to develop a 100M-bit microchip. Other sources indicate that even 1G-bit memory chips may be possible before the end of the century.

Clearly the VLSI and Ulsi revolutions occurring so close together in an internationally competitive environment will create more, rather than less, stability in the electronics industries. Most high-technology market segments that depend on microchips are due for even more intensified and rapid change and an unprecedented multitude of shakeouts.

Szuprowicz is president of 21st Century Research of North Bergen, N.J., and publisher of Supergrowth Technology USA.

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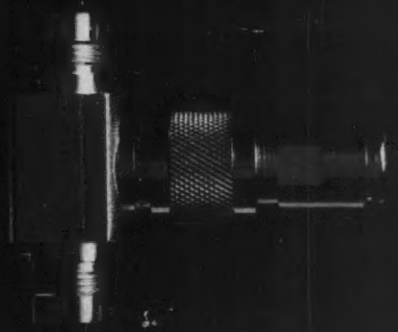
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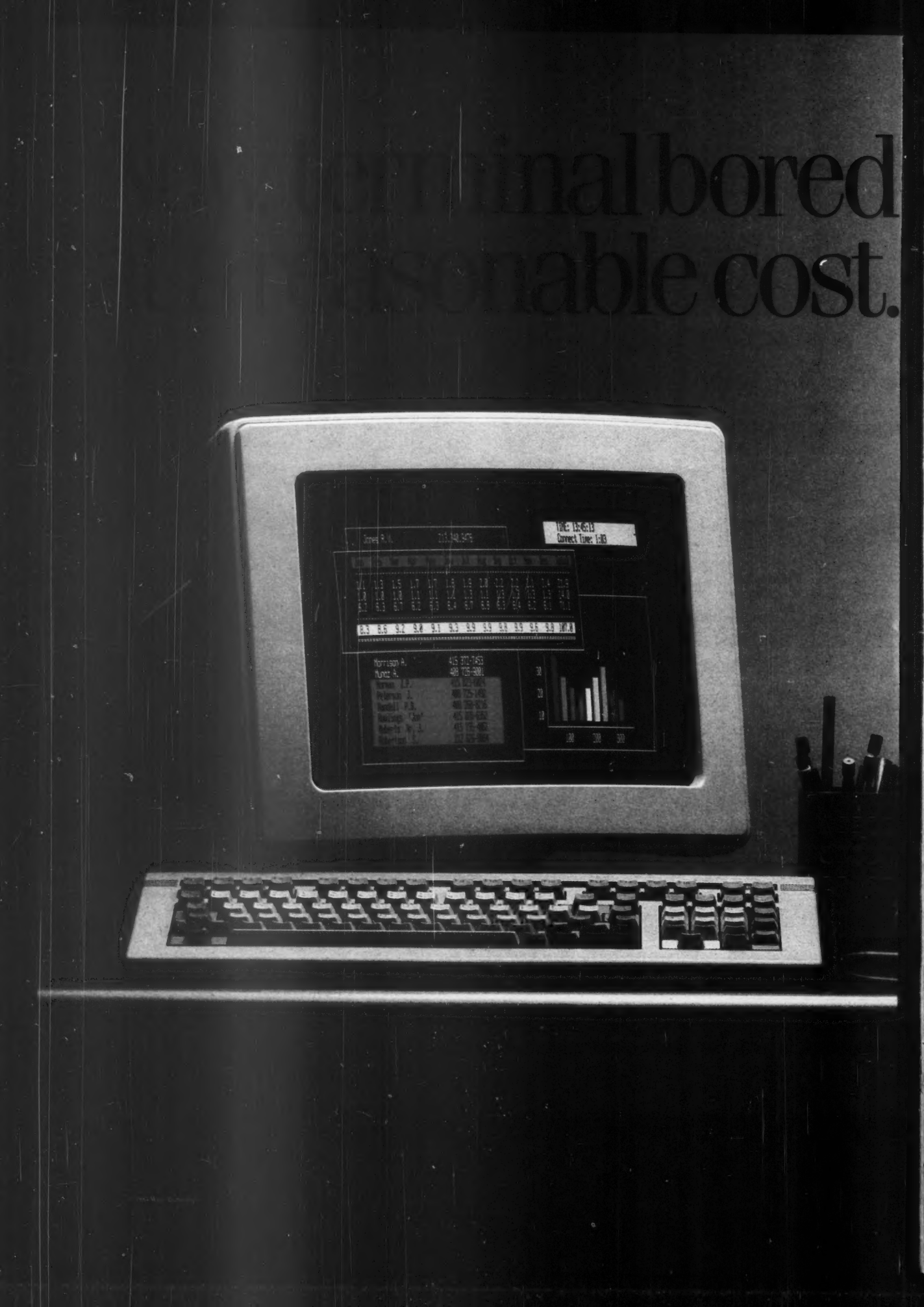
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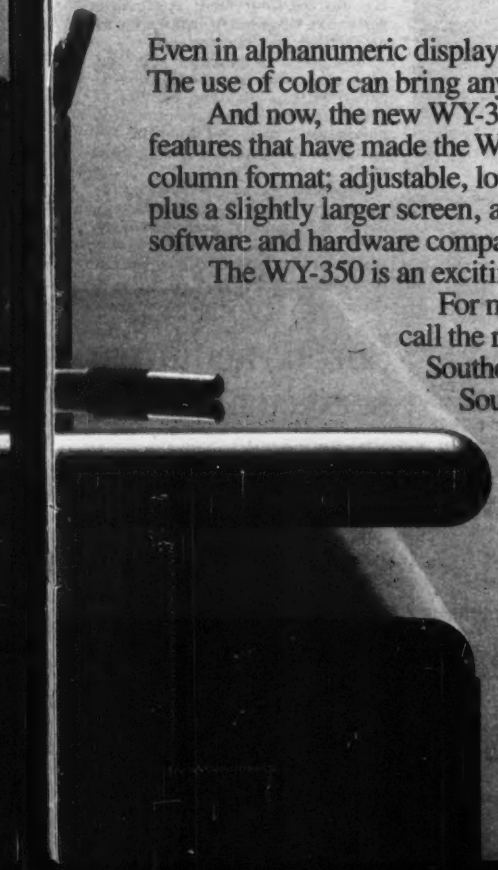
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AI specialist sees $5 billion expert systems mart by 1990

By Mitch Betts
CW Washington Bureau

ST. PAUL DE VENCE, France — Business and military applications of expert systems technology will be commercially available in about five years and may constitute a $5 billion market by 1990, according to Atle Fjeld, an artificial intelligence specialist at Sperry Corp.

At a recent press briefing here, Fjeld said Sperry, based in New York, is working on 22 different applications for expert systems, ranging from airline reservations and oil drilling to computer-aided design and battle management.

In the DP operation, expert systems could make large data bases more manageable through the use of smart data dictionaries, he said. Fjeld asserted that the bridge between traditional DP technology and expert systems is data base technology, because an expert system manipulates a knowledge base that is much like a data base.

In the public sector

In the public sector, Fjeld said, the Social Security Administration could reduce its administrative costs by capturing its Social Security eligibility rules in an expert system and then using the system to screen applicants.

In general, he said, expert systems can help business and government managers control information overload, because the system can refine the incoming data and suggest a course of action.

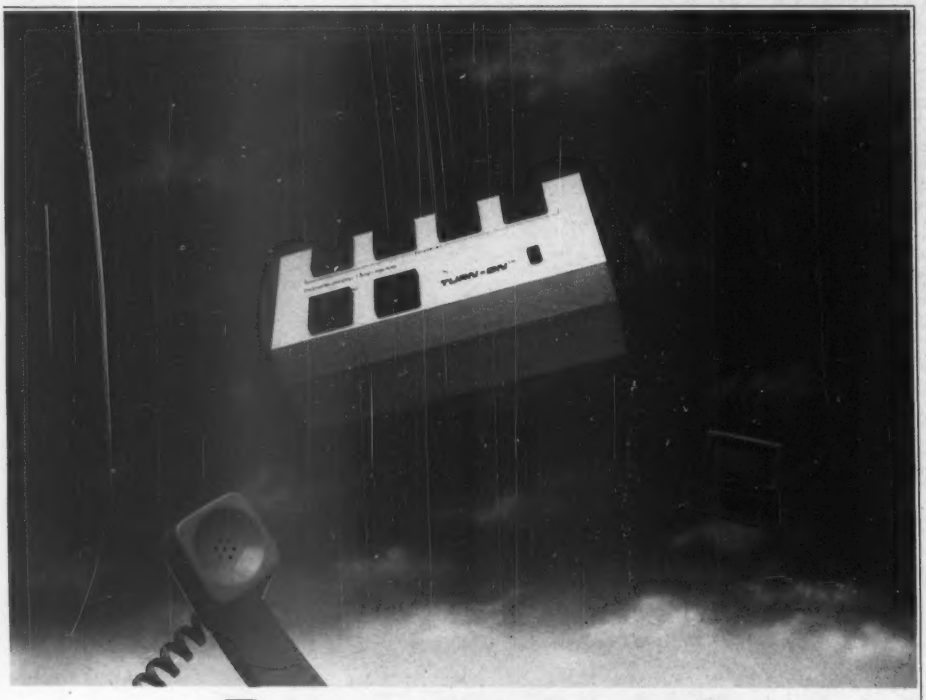
Fjeld said expert systems are most cost-effective when they are applied to management problems that meet the following conditions:

- A difficult problem that already has been solved by an expert.
- Knowledge that can be acquired and represented in the computer.
- A problem that needs to be solved regularly.
- Expertise that is scarce or unevenly distributed.

Sperry management is stressing the importance of this market, Fjeld said, and plans to spend $200 million during the next five years in hopes of capturing 15% to 20% of the world market.

Fjeld is the senior technical manager of Sperry's Knowledge Systems Center in Bloomington, Minn., which employs 150 people. The center, which reports directly to Sperry's chief executive officer, also has established artificial intelligence training centers in Princeton, N.J., and in McLean, Va., and in Birmingham, England.

Sperry's approach to the market is to develop commercially viable systems based on technology developed by other companies, Fjeld said. To this end, Sperry has cooperative agreements to develop systems using Explorer Lisp workstations from Texas Instruments, Inc. [CW, July 15] and expert systems development tools from Intellicorp of Palo Alto, Calif.



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Datapoint to settle suits

SAN ANTONIO — Datapoint Corp. announced last week that it has agreed in principle to a $22.5 million settlement of stockholder litigation related to alleged company violations of securities laws.

The alleged violations occurred during a period from Aug. 1, 1980 to May 4, 1982 and resulted in a number of actions that were consolidated into a single class action suit in the U.S. District Court here. A separate derivative suit filed in Delaware was also settled, the company said.

In a prepared statement the company said it agreed to settle the litigation without admitting liability to avoid "the extensive commitment of management time and financial resources required to continue" with a trial.

According to the company, its insurers will pay $16 million; $3 million will be paid from an indemnity trust fund established earlier in the year, and $3.5 million will be paid directly by the company.

Sorbus acquires service firm

FRAZER, Pa. — Sorbus, Inc., Bell Atlantic Corp.'s third-party computer maintenance subsidiary, recently acquired Computer Maintenance and Leasing Corp. (CMLC), a Minneapolis-based firm servicing IBM equipment. Terms were not disclosed.

Sorbus Senior Vice-President Michael B. Chamberlain said the acquisition strengthens Sorbus' presence in the IBM third-party maintenance market and adds 350 CMLC customers totaling an annual $3 million in revenue.

The agreement took effect Aug. 1. Sorbus said it will integrate CMLC's field engineering and management employees into its own national work force of 1,500.

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Computer Automation plans sale of division

IRVINE, Calif. — Computer Automation, Inc. recently announced it has agreed in principle to sell its Commercial Systems division to W. Norris Agee, a Santa Ana, Calif., businessman who is also chairman of Trendata Corp.

The agreement, which includes the sale of Computer Automation's UK subsidiary, is reportedly contingent upon execution of a definitive agreement and approval by Computer Automation's board of directors and major lender.

The division manufactures Computer Automation's line of Syfa distributed data processing systems and employs 125 people in the U.S.

Computer Automation, which has posted losses in the past two years, was unable to devote adequate resources to the division, according to George Pratt, chairman and chief executive officer.

Financial terms of the agreement were not revealed, but Pratt said it would not result in a loss to the company.

Completion of the transaction is expected by Sept. 30.

Memorex bails out of two joint disk-drive ventures

SANTA CLARA, Calif. — Memorex Corp. recently announced the end of its participation in two four-year-old disk drive component joint ventures with Control Data Corp.

The companies said they will dissolve the operations of Disk Media, Inc. (DMI), a rigid-disk manufacturer in Westlake, Calif. DMI employs about 200 people.

In the same announcement, Memorex said it agreed to sell its share in Peripheral Components, Inc. (PCI) to Magnetic Peripherals, Inc. (MPI), CDC's loss-plagued thin-film recording head subsidiary. Minneapolis-based PCI, which also makes thin-film heads, will operate as a wholly owned subsidiary of MPI. Memorex said it will continue to buy thin-film heads for its IBM-compatible disk drives from PCI.

Memorex, a subsidiary of Burroughs Corp., will replace its supply of rigid disks from DMI by expanding its 3680 disk manufacturing operation here.

CDC said it will supply its rigid-disk requirements from a CDC facility in Omaha.

TRW unit to establish Calif. center

PARSIPPANY, N.J. — The Ultimate Computer Services, Inc. (UCS) operation of TRW, Inc.'s Customer Service Division recently announced that it will open a Baldwin Park, Calif., center for the reconditioning and refurbishing of computer equipment.

UCS, which operates similar centers in Rockaway, N.J., and Bensenville, Ill., said the West Coast equipment reconditioning operation will open Sept. 3.

The center will reportedly include staging and testing of water-chilled systems, a raised-floor area to simulate conditions in a data center environment and computerized work flow and inventory control.

Services provided by the company include relocation, features modification, sales, warehousing and refurbishing.

MERGERS AND ACQUISITIONS

United Technical Products, Inc. (UTP) of Canton, Mass., announced that the company has been acquired by a unit of **HMK Industries, Inc.** HMK is a manufacturing and distribution company headquartered in the Boston area. UTP will operate as an autonomous subsidiary of HMK.

■

Continental Telecom, Inc. (Contel) and **IPC Communications, Inc. (IPC)**, Atlanta, announced an agreement in principle under which Contel would acquire IPC in an exchange of stock valued at approximately $55 million.

It was reported that, under the agreement, Contel would issue an aggregate of 2.3 million shares of its common stock in exchange for all of the issued and outstanding shares of IPC.

The agreement would result in an exchange ratio of approximately one-half of a share of Contel common stock for each share of IPC stock.

Advance Circuits, Inc., Hopkins, Minn., and **Multaplex Corp.** announced they have executed an agreement whereby Advance Circuits will acquire the multilayer printed-circuit manufacturing operations of Multaplex for approximately $10.5 million in cash.

The transaction, which has an effective date of Sept. 3, is subject to the approval of Multaplex shareholders.

■

Hewlett-Packard Co., Palo Alto, Calif., has agreed in principle to acquire an equity interest of approximately 15% in Taiwan-based **Microelectronics Technology, Inc. (MTI)**

Final agreement is subject to approval by shareholders of MTI, the HP board of directors and the government of Taiwan.

■

Bishop Graphics, Inc. announced that **Perfectdata Corp.** has agreed in principal to be acquired by Bishop.

Under the terms of the proposed agreement, Bishop will acquire 100% of Perfectdata's stock in exchange for an undisclosed amount of Bishop shares.

The acquisition is subject to the approval of the board of directors and shareholders of both companies. The target date for completion of the acquisition is Sept. 1.

■

Sytek, Inc., Mountain View, Calif., announced that **General Instrument Corp.** has increased its interest in Sytek by exercising an option to acquire additional shares.

The option is for an equivalent 1.4 million shares of Sytek common stock, increasing General Instrument's ownership to 6.4 million shares, or 57% from 51%, prior to exercise of the option.

■

Control Data Corp., Minneapolis, announced the acquisition of **Computer Maintenance, Inc.**, a third-party computer maintenance vendor based in Denver.

Terms of the agreement were not disclosed.

■

The acquisition of Buffalo, New York-based **Software Distribution Services** by **Ingram Software, Inc.**, of Nashville has been completed. The combined companies will be known as Ingram Software Distribution Services, Inc. and will be a wholly owned subsidiary of the Ingram Distribution Group.



Tandon posts quarterly loss

CHATSWORTH, Calif. — Tandon Corp. recently reported a loss of $14.9 million, or 29 cents per share, for the third quarter ended June 28. The results brought Tandon's losses for the first nine months of fiscal 1985 to $50.2 million.

Third-quarter revenue fell to $62.3 million, compared with $106.2 million in the year-earlier quarter. Tandon earned $10.4 million, or 21 cents per share, in the third quarter of 1984.

Tandon's pretax loss in the third quarter was posted at $21.3 million. A spokesman attributed the loss to inventory write-downs for older product lines and start-up costs associated with the development of products.

A spokesman cited "significant start-up and maturation costs" during the quarter from the development and production of 3½-in. Winchester hard disk drives, 5¼-in. high capacity Winchester drives and IBM-compatible computer systems.

SPECIAL REPORT

Minis and Small Business Systems

September 30

The September 30th Special Report will take a close look at the minicomputer and small business systems market. We'll discuss the latest trends in minicomputer architectures and examine the evolving supermini market. And we'll cover what's happening in the supermicro market and how it's affecting the mini market. We'll include reports from users on the problems that they encounter in selecting and implementing minicomputer systems and the solutions they discovered.

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TREND from page 81

For the rest of the computer industry, the continued depressed state of U.S. sales and dips in foreign sales could generate some very poor financial results for the current reporting period. If that turns out to be the case, the past few months of isolated layoffs and shutdowns could very quickly turn into a general trend in coming weeks as vendors move to balance costs against gross incomes.

■

After recently posting its first quarterly loss in two years [CW, Aug. 5], Applied Data Research, Inc. nonetheless expressed confidence that a traditionally strong second half would produce year-end profits of $2.10 per share. On Aug. 8, however, the company said it expects profits in the range of $1.50 per share for the year. The company said a continued slowdown in buying decisions in July leaves it less confident that it can make up the first-half shortfall.

■

The leading lights in the microcomputer software arena appear to be staying afloat quite nicely. Privately held Microsoft Corp. recently announced that it had sales of $140 million for the year just ended.

Microsoft founder Bill Gates said, "Our long history of success indicates a strong, viable, growing company in an industry that has seen its share of flash-in-the-pan ventures."

While the microcomputer software segment of the industry seems poised for a dramatic cycle of compression over the next year, it remains to be seen how long Microsoft can hold off from adopting the aggressive acquisition strategies adopted by the other companies in its league: Lotus Development Corp. and Ashton-Tate.

■

The Computer and Business Equipment Manufacturers Association (Cbema) recently offered a half-hearted apology for its March 6 comments criticizing Sentinel Bio-Tech Products' plan to market a screen to shield computer users from low-frequency emissions of VDTs.

According to a recent statement, "The Cbema March 6 press release was intended to reaffirm Cbema's longstanding position that there are no harmful emissions coming from VDTs. Cbema remains of that view, but withdraws its March 6 statements to the effect that Sentinel was acting in an unethical manner in announcing its marketing efforts."

FASB from page 81

accounting as costs are incurred. The Association of Data Processing Service Organizations, Inc., representing software and services vendors, argued in favor of greater capitalization.

In the past, reporting procedures of companies had varied between straight expensing and capitalization.

In April 1983, the SEC essentially placed a moratorium on the situation by prohibiting companies from switching from the expensing method to the accounting method.

According to securities analysts, the revised standard will boost quarterly earnings of some software companies by as much as 10% to 15%. But the hikes only reflect paper profits, enabling companies involved in development to record as assets some of the costs they previously had to charge off against profits.

DMS appoints two top execs

LEXINGTON, Mass. — Two top-level McCormack & Dodge Corp. executives recently resigned to take the top jobs at Distribution Management Systems, Inc. (DMS), an applications software firm here.

John B. Landry III, who was executive vice-president of research and development at M&D, has been named chairman of the board of DMS, which develops and markets distribution packages, including order entry, inventory management and automated warehouse systems. Robert K. Weiler, M&D's former senior vice-president of marketing, has been appointed to serve as president of DMS.

Formed in 1976, DMS is a privately held company with $6 million to $7 million in annual revenue and approximately 100 employees, according to James L. Fox, the firm's vice-president of finance and administration. Fox said the pair has acquired equity interest in DMS.

A spokesman for M&D said the parting was on good terms, and the two will not be immediately replaced. Robert Kelley, M&D's vice-president of product directions and strategy, will take over some of Landry's responsibilities.

Porter chosen to head Triad

SUNNYVALE, Calif. — Triad Systems Corp. has selected Informatics General Corp. executive James M. Porter to serve as president and chief executive officer.

The announcement was made by William W. Stevens, Triad's current chairman, president and CEO. Porter was executive vice-president of Informatics, which is currently in the process of being acquired by Sterling Software, Inc.

According to Stevens, who will remain as chairman at Triad, Porter will assume his duties Sept. 1. He said that Porter's skills will strengthen the company's top management.



Beehive reorganization OK'd

SALT LAKE CITY — Beehive International, Inc., a maker of IBM- and Digital Equipment Corp.-compatible terminals based here, recently had its reorganization plan approved by a federal court. The decision means the company has exited the reorganization proceedings it entered in October 1984, under protection of Chapter 11 of the Federal Bankruptcy Act.

Beehive agreed to a debt-to-equity conversion that grants 45% of its common stock to its lead creditor, the Federal Deposit Insurance Corp.

Beehive President Joseph F. Carbone Jr. said the firm absorbed a $9 million write-down for closing its Fermoy, Ireland, manufacturing plant. According to Carbone, Beehive's reorganization plan cut the firm's expenses by an estimated $6 million by reducing its work force 50% and trimming discretionary expenses.

Beehive, which posted approximately $30 million in sales in 1984, recorded losses in the last three quarters of the year.

TEST from page 81

ates (called chaebols in Korean), Samsung assembles an American computer, the Hewlett-Packard Co. 3000, in Korea. The U.S. Department of Commerce listed seven U.S. vendors that used Korean manufacturers as of January 1985, including Digital Equipment Corp. (Doosan Computer Ltd.) and Honeywell, Inc. (the Lucky-Goldstar Group).

One of the most recent such OEM assemblies is Leading Edge Products, Inc.'s low-priced Model D, an IBM Personal Computer-compatible micro made by Korea's Daewoo Group. "[The computer industry] has seen a lot of these [U.S.-Korean agreements] already, and we think it gives us the best product at the best price," said Michael Shane, chairman of Canton, Mass.-based Leading Edge.

Samsung will sell its two exported systems exclusively to OEMs, dealers and distributors in the U.S. through its distribution arm, the B. J. Davis Corp. of Akron, Ohio. The goal, Koo said, is for Samsung to break the American ice for higher ticket products still in the development stage back in Korea. "We're working on a 68000-based Unix workstation and a 32-bit Unix machine," Koo said. "We think our next systems will be able to compete very well."

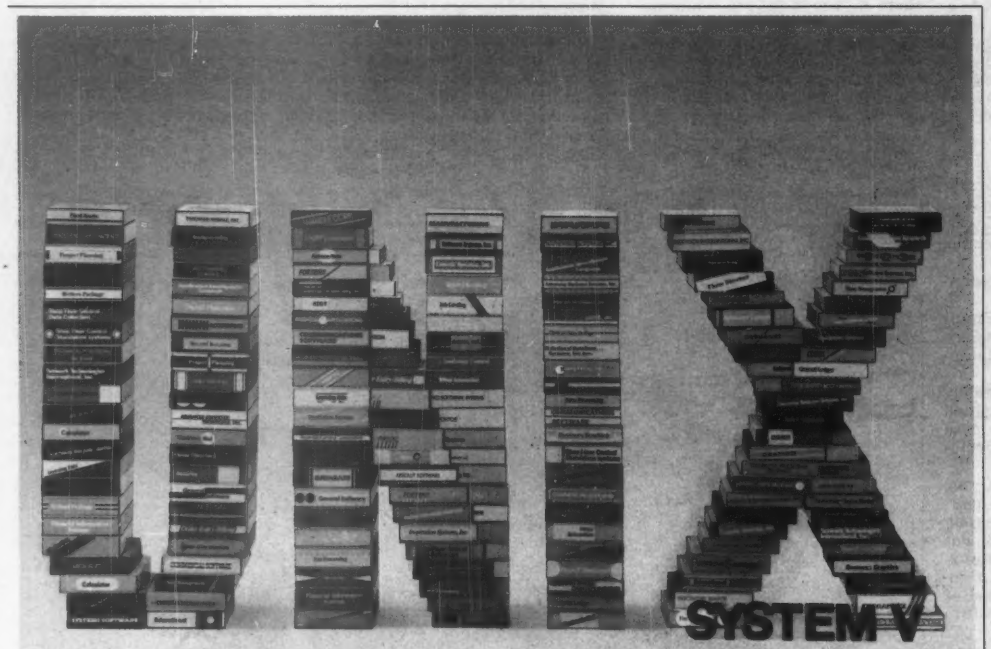
According to Janow, Samsung and other Korean vendors will soon be in the U.S. to stay. "They have some problems in research and design, but I think they'll overcome those," she said. "The global competitors will come from Japan and Korea; I really can't see any other entrants. Five years down the road, they'll be right in there."

SST, founded in 1977 as a wholly owned government corporation called Korea Telecommunications Co., was denationalized in 1980 and taken over by the Samsung Group. Samsung, Korea's largest chaebol, has 26 subsidiary companies doing business in fields as diverse as shipbuilding, petrochemicals, sugar, insurance, hospital equipment, hotels and newspaper publishing.

Samsung's ties to the Korean government remain strong, with joint ventures such as codevelopment of the SSM-16 and the future 32-bit product. But unlike their well-known Asian counterparts in Japan, Samsung and other Korean companies do not receive direct government subsidies.

"The government would like to support us, but it spends a lot of money for defense, and the funds are not there," said Nahm-Wook Lee, executive managing director of SST's computer business group. "We pay a lot of taxes, too."

Lee believes Samsung's strength lies in mass-produced items that can best take advantage of Korea's low-cost labor and components. He acknowledged that Samsung's experimental tryout in the U.S. micro market poses a very different kind of challenge. "It will be very difficult to sell [computer] systems outside of Korea. The No. 1 problem is software support, because there is no one standard product," Lee said.



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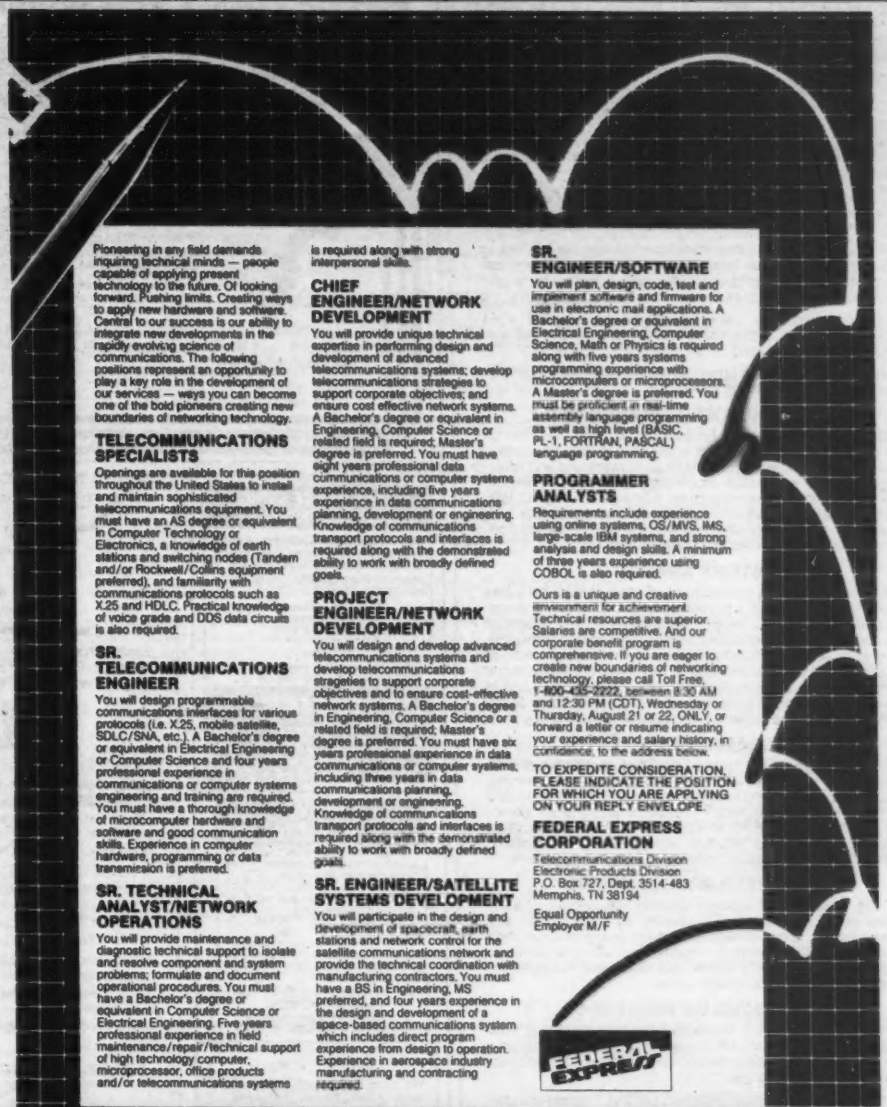
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Candidates for the Data Base Specialist position must have a demonstrated proficiency with IBM 4381 or equivalent mainframe running OS; OS JCL; IBM system utilities; performing in a data base environment and on-line applications.

Under the general direction of the Data Base Administrator, this individual performs the full range of data base requirements in support of user activities. These requirements include the data base management systems design, definition, organization, security, efficiency, documentation, generation, software installation, long-term requirements and operational guidelines. Minimum annual salary is $42,016.00.

Send letter of application, resume and three references to:

Statewide Office of Human Resource Development
University of Alaska
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SAUDI ARABIA
DP CAREER OPPORTUNITIES

The Computer Department at the Ministry of Planning is seeking highly motivated individuals to play a major role in the definition, design, programming and implementation of business, planning and socio-economic systems.

The Ministry of Planning of the Kingdom of Saudi Arabia is responsible for the preparation of the national 5-year development plans and the monitoring of their implementations.

The mandate of the Computer Department in the Ministry of Planning is to provide computer support to its different departments by developing necessary models and systems, and maintaining existing ones.

These systems are being developed on an IBM 4341 VSAM/TSO/ISPF using mainly ADABAS/NATURAL but also COBOL, FORTRAN and SAS.

A number of immediate opportunities are available for DP professionals in the following areas:

OFFICE AUTOMATION MANAGER

MS required in Computer Engineering or Computer Science or equivalent. At least 8 years experience in Data Processing out of which at least 4 years must be in managing and implementing office automation technology. Must have the experience of using the microcomputer software (DBASE II, WP, Spread-sheet etc.). Ideal candidate will also be familiar with the Arabic language business systems and development software. Interpersonal skills and ability to train users.

SYSTEMS ANALYSTS

BS/BA required as a minimum. Must have at least six years experience in DP and a proven track in the following areas: Requirement analysis, project responsibilities from inception through completion, excellent written and verbal communication skills, familiarity with conventional languages, hands-on experience in ISPF, knowledge of data base concepts, experience in using systems development methodologies and in preparing documentation for all phases of the systems development life cycle, experience in statistical modelling is a plus.

PROGRAMMER/ANALYSTS

BS/BA required in CS or related discipline, must have at least four years experience analyzing, designing, programming, testing and maintaining business application systems on IBM mainframe, good knowledge of COBOL and/or PL/1 essential, familiarity with FORTRAN and NATURAL is a plus, good communication skills. Familiar with systems development methodologies and documentation of application systems.

COMPUTER PROGRAMMERS

BS/BA or equivalent diploma required. Must have at least three years experience in preparing program design and specifications, programming and testing business application systems on IBM mainframe, experience in using different access methods including VSAM and data base management systems, good communication skills.

TRAINING INSTRUCTOR

BS/BA required in CS or related discipline. Must have at least five years experience in DP two of which in computer teaching and preparing training materials, excellent written and verbal communications skills.

For all positions, bilingual applicants (Arabic, English) are preferred. All positions are offered on a 2-year contract basis. Excellent benefits package includes free medical care, housing and furniture allowances, education allowances for children, transportation and maintenance allowance, 45-day annual leave and a yearly round-trip ticket to the location of the present residency.

Applicants should immediately send resume including telephone numbers, references, recent passport-size picture, salary history and desired position to:

Computer Department, Ministry of Planning
P.O. Box 358
Riyadh 11411, Kingdom of Saudi Arabia

Telephone: (966) 01-401-0280
Telex: 202075 PLAN SJ

Last date for submission of applications is September 4, 1985.

System Developers
800-231-5920

Inviting resumes from individuals in the more highly technical computer related vocations such as: PHD Computer Scientists, Operating System Developers, Data Base Developers, Porting Specialists, Networks and Telecommunications, Architecture, Artificial Intelligence, Graphics Systems Developers, Microcoders and Firmware Developers, Compiler Development, etc. Special interest in emerging technology such as novel architecture, UNIX, ADA, etc. Similar interest in scientific applications developers including military, process control, data acquisition, telemetry and communications, CAD/CAM, simulation and modeling, etc.—we are a professional employment firm managed by graduate engineers. Fees are paid by the employer. All geographic locations. Send resume or call D.A. Redwine and ask for our free resume workbook & career planner.

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These positions will develop and maintain a large software system for petroleum exploration in the areas of:

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Recruitment & Employment
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Director of Administrative Systems

SUNY Stony Brook invites applications for the position of Director of Administrative Systems. This position is responsible for the planning, development and maintenance of all campus administrative software. Transition to a new mainframe and DBMS over the next three years requires a highly motivated and experienced DP professional to meet this challenge. Qualified candidates must possess a Bachelor's Degree. An educational concentration in the fields of computer systems analysis, design and/or programming at either the baccalaureate or graduate level is required. A minimum of three years recent experience supervising the development of state-of-the-art, on-line administrative computer applications in a large mainframe environment is necessary. University experience would be beneficial. Experience with DBMS software and Fourth generation languages is preferred. Strong leadership, communication and management skills are essential. Salary and benefits are competitive. Send resume and cover letter with salary history by August 31, 1985 to: Mr. A. Rosenblatt, Chairperson, Adm. Bldg. Rm. 254, SUNY Stony Brook, Stony Brook, NY 11794. SUNY Stony Brook is an affirmative action/equal opportunity educator and employer. AK#168-85.

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PROGRAMMER/ ANALYST

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You must have 8-10 years experience in performing various aspects of resource planning, configuration design, hardware/software evaluations, procurements and installation of large IBM central and distributed data centers. Ideal candidate will have background in system programming, capacity planning and related technical services functions in a large IBM multi-host environment. Since you will be presenting your plans, designs and recommendations to Senior EDP management, you must possess excellent oral and written communications skills. A B.S. or M.S. is desired.

We offer highly attractive compensation/benefits programs and advancement opportunities. For immediate, confidential consideration, send resume to: **Neil Birkhahn, Human Resources Specialist, SYSTEM DEVELOPMENT CORPORATION, P.O. Box 12314, Research Triangle Park, N.C. 27709.**

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CTG is the nation's largest professional software services firm with 43 locations and 1985 revenues expected to exceed $110M. Due to our continuing growth, we have immediate needs for several Data Base Analysts and Designers. Requirements include a minimum of 2 years' IBM/COBOL programming/design with additional experience in IMS DB/DC, IDMS or CICS.

If you are looking for a dynamic, growing, stable company that provides a challenging environment, career development, technical education, excellent salary, paid overtime, and outstanding benefits, then this may be the opportunity for you.

For consideration send resume with salary history to:

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Scientific Programmer Analyst

Schering-Plough Corporation is an international leader in the research, development and manufacture of ethical pharmaceutical products. Through the years we have allocated substantial resources in the pursuit of the development of novel pharmaceutical products—focusing on technically advanced pharmaceutical efforts.

It is the commitment and expertise of our people which make it all work. Challenge and opportunity exist for a Scientific Programmer Analyst who can become an integral addition to our creative Research and Development Team.

To qualify, successful candidates should possess a BS or equivalent in Computer Science or related discipline and 4-6 years scientific or clinical applications programming experience utilizing IBM 3083. Knowledge of various computer software systems including SAS and/or INQUIRE; MVS/XA JCL and TSO/ISPF essential. PL/1 or FORTRAN would be desirable.

Schering-Plough is dedicated to scientific excellence and offers a compensation package which includes excellent salary and a comprehensive benefits plan. Qualified candidates should forward their resume with salary history and requirements to: W.A. Schall, Personnel Manager, Box AD85-11, Schering-Plough Corporation, 60 Orange Street, Bloomfield, New Jersey 07003. We are an equal opportunity employer m/f.

Schering-Plough

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General Electric is looking for experienced Development Programmers.

General Information — The Lighting Business Group of the General Electric Company is seeking experienced Development Programmers with demonstrated track records in programming and implementing large marketing, manufacturing and financial systems in DEC and/or IBM environments. We are currently replacing and upgrading our existing business information systems and moving to a databased environment.

Responsibilities include: design, code, test and document programs from detailed specifications. Formulate systems scope and objectives. Revise or modify procedures to solve problems.

Location — Cleveland, OH

Experience — 3-5 years' development programming. Extensive working knowledge of COBOL and IDMS. Experience with ADSO or other fourth generation tools is desirable.

Education — Bachelor Degree in Math or Computer Science.

Salary & Benefit Package — We offer a competitive salary and an outstanding benefits package.

Reply — Qualified candidates interested in applying for this excellent opportunity should forward their resume and salary history (Please No Calls) to:

K.M. Lynch
General Electric Company
Nela Park - Building 314
Noble Road
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An MBA, experience in marketing consulting services to executive-level management, and a diversified track record in general management are essential for this key position.

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Openings at all levels in any of the above. Call Reggie Liptak, 212-307-0939 or submit resume to Interface Inc., 17 West 54 St, NY, NY 10019.

DIRECTOR OF DATA PROCESSING

St. Joseph's Regional Health Center, a progressive 317 bed acute care hospital, is seeking an individual with the knowledge and initiative to lead our expanding Data Processing Department. The successful candidate must have BS degree in Computer Science or comparable working experience; excellent communication skills; with RPG III and data base concepts. Responsibilities include maintenance and upgrade of an on-line IBM System/38 as well as the training and supervision of the data processing staff. We offer an attractive starting salary and excellent range of benefits. For confidential consideration send your resume to Personnel Director, St. Joseph's Regional Health Center, 100 Whittington Ave., Hot Springs, AR 71901. EOE M/F/H.

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Analyst/Programmer - Design, develop and implement commercial and financial applications systems. Use PL/1, VSAM/OS and IBM mainframes. 2 years college with major in Computer Science and/or Math, 3 years experience performing above or as programmer. $38K/year, 40 hours/week. Send resume: NYS Job Service, 97-45 Queens Blvd., Rego Park, NY 11372, JO# NY8015855, D.O.T. 020.167.018, no fee charged.

SYSTEMS PROGRAMMERS
Southern California

Litton Computer Services, one of the nation's leading data processing organizations, is an independent computer services company, innovative and responsive to the needs of both government and private industry. We operate the latest IBM CPUs and equipment (a 3081, 3084 and a 4341) and are currently running MVS/XA.

We have immediate openings for Systems Programmers with a total of 2-3 years experience in the installation, diagnostics, debugging and use of the following software: MVS/SP or MVS/XA, SMP/E, TOP SECRET & JES 2. Successful candidate will have good communication skills, and the ability to work well with a moderate amount of management.

Litton Computer services offers the opportunity to work with the newest sate-of-the-art equipment, in a relaxed atmosphere, conducive to both personal and professional growth. We are located in suburban Woodland Hills, California, just less than 20 miles from downtown Los Angeles, convenient to ocean, desert and mountain recreation areas.

For immediate consideration please send resume, WITH SALARY HISTORY, to:

Sarah Jackson
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Litton Computer Services

EDP MANAGER

Nations second largest Dental Association in Chicago seeks manager experienced in programming, designing, scheduling, equipment/software planning and maintenance of Honeywell Ultimate Pick operating system. RPL language. Will supervise Operator and Data Entry Clerk. Excellent salary/benefits. Send resume with salary requirements to:

Human Resources
Academy of General Dentistry
211 E. Chicago
Suite 1200
Chicago, IL 60611

DATA SYSTEMS COORDINATOR

The Capistrano Unified School District, located along the California coastline mid-way between Los Angeles and San Diego, will accept applications for the position of Data Systems Coordinator (D. P. Director) until Sept. 9, 1985.

The District, of 18,000 students and 25 schools, is a DEC installation with a PDP 11/70 installed, a VAX 11/785 on order and numerous micro computers.

All applications utilize data base management, applications development and 4th generation language tools.

Salary range: $39,212 to $47,882

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Requires MS in Industrial Engineering. Requires two months experience with artificial intelligence systems design, advanced LISP programming, computer vision, Robotics, knowledge-based expert systems design, and SYMBOLIC computers. Monthly salary $2,900.

Submit resumes to:

Mr. D. Hewetson
#5-67
Minnesota Job Service
309 Second Avenue South
Minneapolis, Minnesota 55401

PROGRAMMER ANALYST SYSTEM 38

San Francisco area newspaper seeks a programmer analyst with at least two years experience with RPG III to provide programming support for a variety of business applications on a system 38 model 40. Duties will involve the implementation of software packages, and in-house developed systems.

Contra Costa Times
Personnel Department
P.O. Box 5088
Walnut Creek, CA 94598

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New technical institute seeks full time faculty member to head computer programming, computer electronics technology and office automation departments. Minimum education M.A. or M.S. in computer science, electronics or related field. Must have strong background in both computer science and computer electronics. Teaching and industrial experience required. Salary commensurate with experience. Submit letter of interest, resume and references to:

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Job reference number: 600988

Apply to Ms. Mary Ann Procak
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3301 Lancaster Avenue
P.O. Box 2169
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Research and development in the field of embedded real-time distributed and parallel processing architectures, multi-level interconnections, distributed operating systems design, high performance fault tolerant distributed architectures, and algorithm partitioning analysis.

Requires Ph.D degree in Computer and Information Science. Requires 9 months experience with high performance computer architecture and distributed operating systems. Requires knowledge of parallel algorithm design and analysis and interconnect networks gained through 50 credits graduate level coursework in Computer Science or Engineering or 9 months work experience. Salary $3,520.00 per month.

Submit resumes to:

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#5-64
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309 Second Avenue South
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(203) 278-7170
900 Turks Head Bldg., Providence, RI 02903
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Forward resume with salary requirements to:

James Johnson
Information Services

American Hospital Supply Corporation

1400 Waukegan Road
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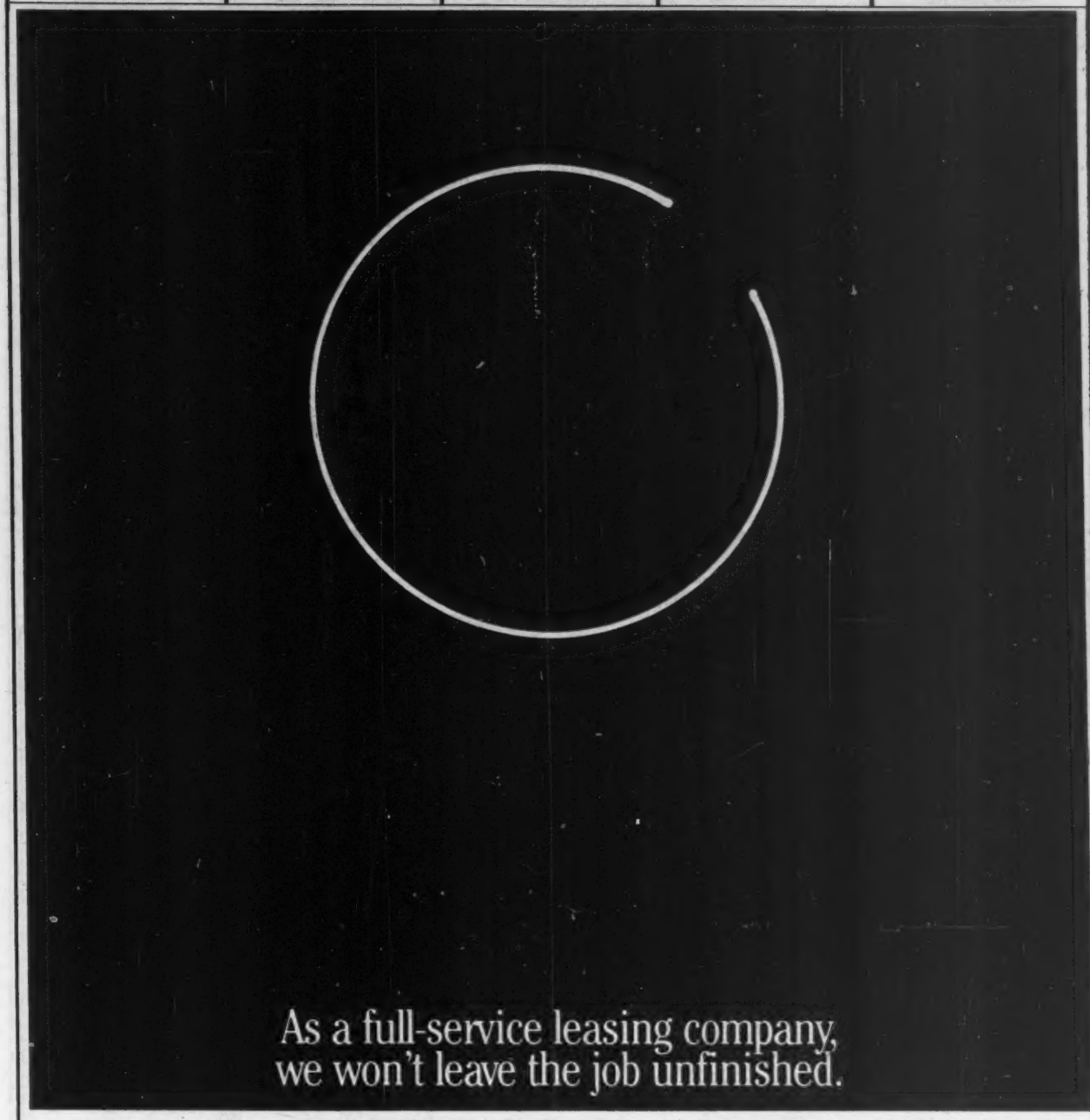
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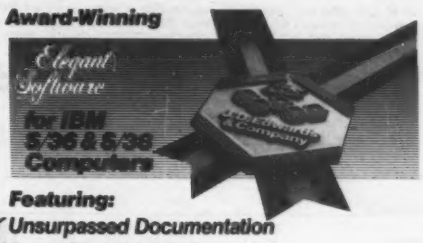
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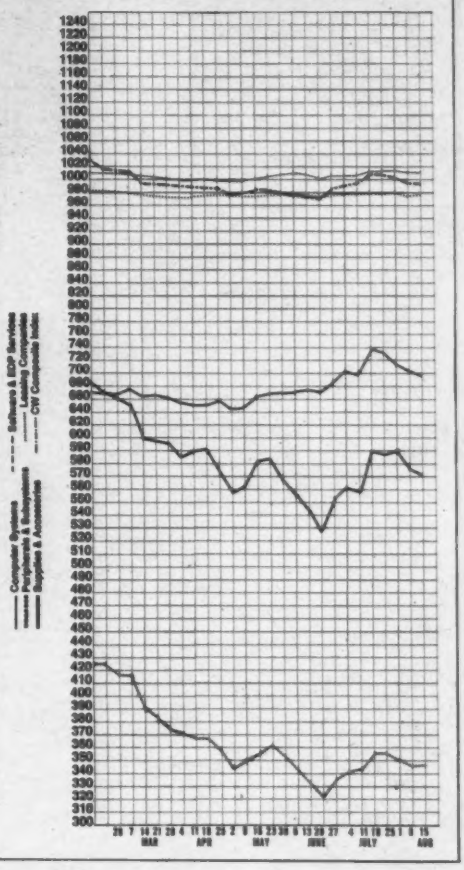
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COMPUTER SYSTEMS

		1985 RANGE (1)	CLOSE AUG 14 1985	WEEK NET CHANGE	WEEK PCT CHANGE
O	ALPHA MICROSYSTEMS	3- 12	5 7/8	- 1/8	-2.0
O	ALTOS COMPUTER SYST	7- 14	10 3/4	-1 1/4	-10.4
A	AMDAHL CORP	10- 19	13 3/4	+ 3/8	+2.8
O	APPLE COMPUTER INC	14- 31	14 5/8	- 1/4	-1.6
N	AT&T	18- 25	20 5/8	- 1/4	-1.1
N	BURROUGHS CORP	51- 68	62 1/2	+ 3/8	+0.6
O	COMPAQ COMPUTER CP	4- 12	10 1/2	0	0.0
O	COMPUTER AUTOMATION	3- 8	8 3/4	+ 5/8	+10.2
A	COMPUTER CONSOLES	8- 20	12 3/4	+ 3/8	+3.0
N	CONTROL DATA CORP	25- 38	33 3/8	-3 1/4	-12.2
O	CONVERGENT TECHNOL	5- 12	9 1/8	+ 3/8	+4.2
O	CPT CORP	5- 12	9	+ 1/8	+1.4
N	CRAY RESEARCH INC	48-100	81 1/2	-1	-1.0
O	DAISY SYSTEMS CORP	3- 10	7	+ 3/4	+12.0
N	DATA GENERAL CORP	31- 76	38 3/8	+1 7/8	+5.3
N	DATAPOINT CORP	11- 23	8	+2 3/8	+42.8
N	DIGITAL EQUIPMENT	68-128	101 5/8	+ 3/4	+0.7
A	ZECO INC	13- 19	14 7/8	+ 1/2	+3.4
N	ELECTRONIC ASSOC.	3- 6	4 7/8	+ 1/2	+11.4
N	FLOATING POINT SYST	19- 35	31 1/2	+ 1/2	+1.6
N	FONSORO	24- 34	28 1/4	- 1/2	-1.8
N	GOULD INC	20- 32	28 1/4	+ 7/8	+3.4
N	HARRIS CORP	29- 39	35 5/8	+ 7/8	+2.1
N	HEWLETT-PACKARD CO	31- 44	38 5/8	- 1/8	-0.3
N	HONEYWELL INC	53- 67	63 3/4	0	0.0
N	IBM	118-138	125 3/4	-2 1/2	-1.9
O	IPL SYSTEMS INC	1- 4	1 7/8	- 1/4	-11.7
N	ITT CORP	24- 37	32 3/4	- 3/8	-1.1
N	M/A-COM INC	16- 34	30	- 7/8	-2.0
O	MANAGEMENT ASSIST	2- 20	2 3/8	0	0.0
N	MATSUSHITA ELEC(ADR)	52- 88	69 1/8	+ 3/8	+1.1
N	MODULAR COMPUTER SYS	5- 10	7	0	0.0
N	MORROW DATA SCI	2- 15	2	- 1/8	-5.8
N	MOTOROLA INC	28- 57	32 7/8	+1 7/8	+1.7
N	NAT'L SEMICONDUCTOR	10- 17	13 1/2	- 1/4	-1.8
N	NBI INC	13- 31	18 1/2	+1	+5.8
N	NCR	23- 38	32 1/2	0	0.0
N	PERKIN-ELMER	22- 36	30 5/8	+ 3/8	+1.4
N	PRIME COMPUTER INC	15- 28	24 3/8	- 1/4	-1.3
N	SPERRY CORP	35- 58	48 7/8	-1	-2.0
O	STRATUS COMPUTER INC	8- 19	17 1/2	+ 1/4	+1.4
O	TANDON COMPUTERS INC	14- 28	19 3/8	- 1/4	-1.3
N	TANDY CORP	24- 37	32 7/8	+1 7/8	+6.0
O	TELEVIDEO SYSTEMS	2- 7	2 3/8	0	0.0
N	TELXON CORP	7- 18	15	- 1/4	-1.6
N	TEXAS INSTRUMENTS	88-148	98 3/8	-1 3/8	-1.3
A	ULTIMATE CORP	8- 24	13 3/8	+1 5/8	+13.8
O	VECTOR GRAPHICS INC	4- 9	5	0	0.0
A	WANG LABS "B"	19- 32	17 5/8	+ 3/4	+4.4
A	WANG LABS "C"	19- 32	17 1/4	0	0.0
N	WORDS CORP	17- 35	32 1/2	+ 1/8	+0.2

LEASING COMPANIES

N	COMDISCO INC	9- 19	17 3/4	- 1/4	-1.3
O	CONTINENTAL INFO SYS	5- 12	11 1/4	+ 7/8	+8.4
O	FINALCO GROUP INC	7- 9	9	+ 3/4	+17.1
O	PHOENIX AMERICAN INC	2- 8	2 1/4	- 1/8	-5.2
O	SELECTERM INC	8- 14	8 1/8	+ 1/8	+1.5
N	U.S. LEASING	30- 43	34 3/4	+1	+2.8

COMPONENTS

N	ADVANCED MICRO DEV	23- 41	38 3/4	- 1/2	-1.7
O	ANN'S SEMICONDUCTOR	10- 25	10 1/2	- 1/2	-4.5
N	ANALOG DEVICES INC	16- 25	22 1/8	- 3/8	-1.6
O	ANALOGIC CORP	8- 18	14 5/8	0	0.0
N	APPLIED MAGNETICS CP	5- 16	14 1/2	+ 5/8	+4.5
O	HADCO CORP	3- 10	6 1/8	0	0.0
O	MICRO MASK INC	8- 14	8	+ 1/4	+3.2
N	TERADYNE	20- 39	32 1/4	- 3/8	-1.8

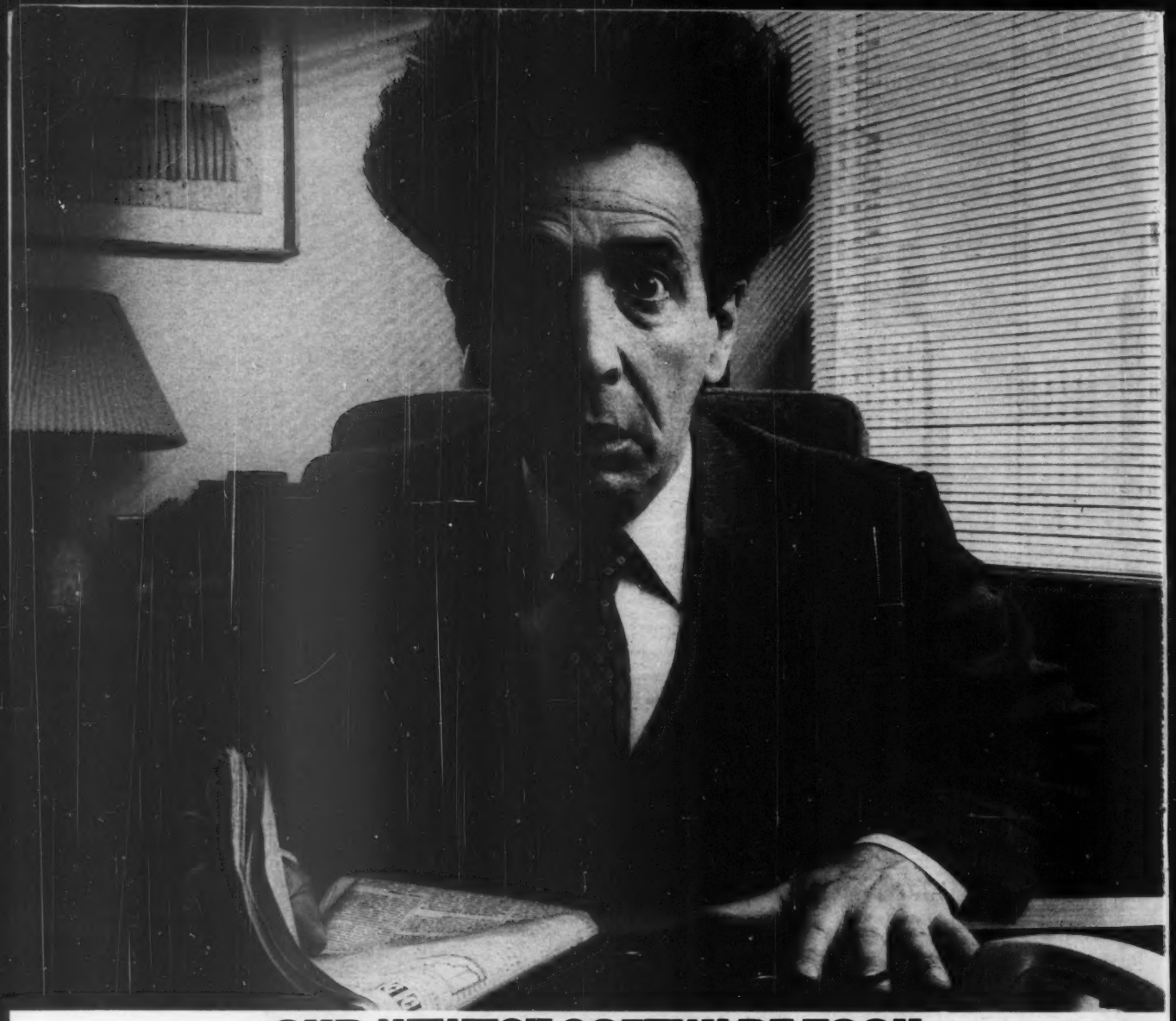
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O	ADVANCED COMP TECH	2- 4	3	- 1/4	-7.8
N	ADVANCED SYSTEMS INC	9- 20	12 1/4	+ 3/8	+3.1
N	ASK COMPUTERS INC	10- 17	16	+ 1/4	+1.5
O	AMERICAN SOFTWARE	7- 15	13 3/4	- 1/4	-1.7
N	AMACOMP INC	1- 4	2 7/8	- 3/8	-11.5
O	ANALYSTS INTL CORP	5- 11	9 1/2	+ 1/2	+5.9
O	ASHTON TATE	8- 13	12 1/2	+ 7/8	+7.5
O	ASK COMPUTER SYSTEMS	11- 24	13 5/8	+ 1/8	+0.9
O	AUTOMATRIX CORP IND	1- 7	2 3/4	0	0.0
N	AUTOMATIC DATA PROC	39- 55	48 3/4	-1 1/4	-2.5
O	COMPUTER ASSOC INT'L	18- 30	23 1/4	-2 1/2	-8.7
O	COMPUTER HORIZONS	5- 11	11	+ 5/8	+6.0
O	COMPUTER NETWORK	3- 10	7 1/4	+ 1/4	+3.5
N	COMPUTER SCIENCES	12- 22	20 3/8	- 1/2	-2.3
O	COMPUTER TASK GROUP	10- 20	18 1/4	- 1/2	-2.6
O	COMPUTER USAGE	1- 3	2 1/2	+ 1/2	+25.0
O	COMPUTERVISION	6- 11	8 1/2	+ 1/2	+6.3
O	CONSERV CORP	1- 6	3	0	0.0
O	COSMICAR	8- 10	8 3/8	- 1/8	-1.4
O	CULLINET SOFTWARE	10- 33	18 1/2	- 1/8	-0.6
O	CYCARE SYSTEMS INC	10- 27	20	0	0.0
O	DIGITAL SYSTEMS INT	4- 15	4 3/8	0	0.0
N	GENERAL ELECTRIC CO	53- 80	80 7/8	-1 7/8	-3.0
N	GEN. MOTORS E (EDS)	17- 47	39 3/8	-3 5/8	-8.4
N	GTE CORP	39- 45	39 7/8	- 5/8	-1.5
N	INFORMATICS GENERAL	13- 27	20 7/8	0	0.0
O	INFORMATION SCIENCE	1- 6	2	0	0.0
O	INFOTRON SYSTEMS CP	15- 28	21 3/4	+ 1/4	+1.1
O	KEANE ASSOCIATES	9- 18	17	0	0.0
N	LOGICON	24- 38	29	-2 1/8	-5.7
O	LOTUS DEVELOPMENT CP	17- 34	28	+ 1/2	+1.8
O	MCI COMMUNICATIONS	7- 11	8 1/8	0	0.0
O	MGT SCI AMER INC	9- 16	14 1/4	- 3/8	-2.5
O	MATHEMATICAL APP GRP	3- 6	3 3/8	0	0.0
O	MICOM SYSTEMS INC	14- 42	20	+ 1/4	+1.2
O	MICROPRO INT'L CP	2- 4	2 1/2	+ 1/8	+5.0
O	NATIONAL DATA CORP	7- 15	15 3/8	- 1/4	-1.6
O	ON-LINE SOFTWARE INT	4- 10	9 3/4	- 1/2	-8.0
O	PANSOFT SYSTEMS	11- 29	23 1/4	+ 1/8	+0.5
N	PLANNING RESEARCH	9- 17	15 3/4	+ 5/8	+4.1
O	POLICY MGMT SYSTS CP	18- 38	17 5/8	-1 1/8	-8.0
O	PROGRAMMING & SYS	4- 8	8 3/8	- 3/8	-8.2
O	REYNOLDS & REYNOLD	29- 44	40 1/2	0	0.0
O	SEI CORP	11- 19	17 3/4	- 1/2	-2.7
O	SHARED MEDICAL SYST	24- 34	31 1/8	+1 1/4	+4.1
O	SCIENTIFIC COMPUTERS	5- 12	6	- 1/8	-2.0
O	SOFTWARE AG	1- 22	22	+ 1/4	+1.8
N	SSE CORP	10- 14	12	+ 3/8	+3.2
N	UCCEL	9- 17	15	0	0.0

PERIPHERALS & SUBSYSTEMS

P	AM INTERNATIONAL	3- 9	3 5/8	- 1/8	-3.3
A	ANDERSON JACOBSON	3- 11	2 7/8	+ 1/8	+4.5
O	ARI RESEARCH INC	7- 12	10 7/8	+1 7/8	+10.5
O	AUTO-TROL TECHNOLOGY	8- 19	8	- 1/4	-4.0
O	AVANT-GARDE COMPUTING	8- 18	7 1/2	0	0.0
O	BANCTEC INC	5- 13	8 5/8	- 3/8	-3.7
O	BEEHIVE INT'L	1- 2	1/8	0	0.0
N	BOLT-BERANEK & NEW	15- 39	29 3/8	+ 5/8	+2.2
O	CANBEX CORP	1- 5	1 1/8	0	0.0
N	CENTRONICS DATA COMP	3- 12	4 3/8	+ 1/4	+6.0
A	CETEC CORP	5- 10	7 1/8	+ 5/8	+9.6
O	COGNITRONICS	4- 7	5 1/2	+ 1/4	+4.7
O	COMPUGRAPHIC CORP	28- 37	27 1/8	- 1/8	-0.4
O	COMPUTER TRANSCEIVER	1- 4	3	0	0.0
N	COMPUTERVISION CORP	12- 46	16 7/8	0	0.0
N	CONRAC CORP	12- 18	13 1/2	0	0.0
A	DATAPRODUCTS CORP	11- 24	12 7/8	+ 1/4	+1.8
A	DATRON CORP	3- 7	6	+ 7/8	+17.0
O	DATA SWITCH CORP	4- 8	6 5/8	+ 1/2	+12.1
O	DATUM INC	5- 9	8 1/2	+ 1/8	+2.3
O	DECISION DATA COMPUT	9- 18	12 1/2	- 3/8	-2.8
O	DOCUTEL-OLIVETTI	3- 8	5 3/8	0	0.0
O	ENDATA, INC	3- 8	7 1/2	+ 1/4	+3.4
O	EVANS & SUTHERLAND	11- 20	13 3/4	0	0.0
O	GANDALF TECHNOLOGIES	6- 14	17 1/4	+1	+6.1
N	GEN'L DATA COMM IND	13- 20	16 1/4	- 3/8	-2.3
N	HAZELTINE CORP	23- 38	32 5/8	+ 3/8	+1.0
O	ICOT CORP	3- 8	28 1/4	-1	-3.4
O	INFORMATION INTL INC	10- 17	12 1/2	- 1/8	-1.0
O	INTECOM INC	4- 12	18	+ 1/2	+3.2
O	INTEL CORP	23- 38	0 3/8	+1	+10.8
A	LUNDY ELECTRONICS	7- 14	27 1/2	- 3/4	-2.8
O	MEDADATA CORP	4- 8	12 3/4	+ 1/8	+0.9
A	MEI DATA CORP	7- 13	4 3/8	0	0.0
N	MARMON CORP	21- 30	7 3/4	- 1/4	-3.1
N	NETWORK SYSTEMS CORP	15- 27	28 1/4	+ 1/8	+0.4
N	NE AMERICAN PHILIPS	33- 48	23 5/8	-1 5/8	-6.4
N	NORTHERN TELECOM LTD	30- 42	34 3/4	+ 5/8	+1.8
O	OMEX	1- 3	27 1/4	+ 1/8	+0.3
N	PANASYNE CORP	9- 18	3/8	0	0.0
A	PENRIL CORP	8- 14	10 3/4	+ 1/4	+2.4
N	PLESSEY CO (ADR)	20- 29	8	- 1/4	-2.7
O	PRINTRONIX INC	8- 22	20 1/2	0	0.0
O	RMS INC	8- 17	12	+ 1/4	+2.1
O	RAYTEK CORP	3- 8	10 3/4	- 1/8	-1.1
N	RECOGNITION EQUIP	8- 17	9 3/4	- 1/4	-2.4
N	SANDERS ASSOCIATES	22- 51	10 3/8	0	0.0
O	SCAN-TRON CORP	11- 18	29 1/2	+1	+3.7
N	SCIENTIFIC ATLANTA	8- 14	15	- 3/4	-4.7
O	SEAGATE TECHNOLOGY	4- 13	12 7/8	- 1/4	-1.8
N	TIMEPLEX INC	2- 12	7 1/4	+ 3/8	+5.4
O	SYKES DATATRONICS	1- 3	2 3/8	0	0.0
A	T DMF INC	3- 11	1/2	-	-11.1
A	TAB PRODUCTS CO	13- 20	5 5/8	- 3/4	-12.7
O	TANDON CORP	4- 13	10 1/2	+ 1/2	+5.0
A	TNC INC	8- 13	4 3/8	- 1/4	-5.4
N	TEKTRONIX INC	54- 88	0 1/4	- 3/4	-7.5
N	TELEX	30- 48	62 7/8	- 3/4	-1.1
O	TESDATA SYSTEMS CP	1- 4	40 3/8	-1 3/8	-3.2
N	TIMEPLEX INC	19- 23	1 1/2	+ 1/8	+8.0
N	TITAN CORP	9- 8	10 1/8	- 1/4	-1.2
O	VISUAL TECHNOLOGY	1- 10	1 1/4	+ 1/8	+10.8
N	AMERICAN BUS PRODS	21- 33	25 5/8	- 3/4	-2.8
N	BARRY WRIGHT	18- 33	22 3/4	+ 7/8	+4.0
A	BURLEK PRODUCTS INC	13- 19	18 3/4	+ 1/4	+1.3
N	ENNIS BUS. FORMS	16- 30	18 3/8	+ 1/8	+0.6
N	3M COMPANY	76- 98	78 1/4	-1 7/8	-2.3
N	MOORE CORP LTD	13- 22	15	0	0.0
A	STANDARD REGISTER	18- 28	21 1/4	- 3/4	-2.3
N	WALLACE COMP SERVICE	28- 40	35 3/8	-2 3/8	-6.8



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